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Testing Again.

We referred in March last to a discussion held by the Institute of Metals on the testing of castings, prefaced by a Paper by Dr. Rosenhain, which included as an appendix his judicial summary of the opinions expressed at a discussion on this subject which took place before an international audience of metallurgists at Zurich in September last. The later discussion was particularly interesting, and, in the main, the views adumbrated in the preliminary Paper were supported. This is of interest because although the Zurich discussion arose mainly out of, and dealt with, the problem of testing cast iron, the London discussion referred principally to non-ferrous metals. There are quite definite signs that the transverse test so widely used in cast-iron foundries is likely to be developed for the low elongation non-ferrous alloys.

Contributions to the discussion made in writing are also available in the recently issued Vol. 28 of the "Journal of the Institution of Metals." These include a long contribution from Professor Portevin, the tenour of which may be judged from the fact that in his reply Dr. Rosenhain regrets that Professor Portevin's views have been less influenced by the discussion at Zurich than had generally been supposed, and, quite rightly, points out that Professor Portevin is not justified in suggesting that the preference for the separately-cast test-bar is due to conservatism. Other contributions in writing include one from Professor Piwowarsky.

During the discussion it was repeatedly suggested that buyers and inspectors prefer the cast-on bar, as a guarantee that the metal of the bar is identical with the metal of the casting, and cast at the same time. It was equally pointed out, however, that makers have, in a considerable measure, to be trusted, and that it was as easy to get a good result from a cast-on test-bar by artificial means as in the case of a separately-cast test-piece. Ultimately the honesty of the foundry had to be relied upon, and the attitude of the metallurgist or founder is that with a carefully specified separately-cast bar, he will be relieved of the difficulty which has so often confronted him in the past—that of making both a good test-bar and a good casting when the specified conditions really only permit of one of these.

Moving.

We have on several occasions recently been asked whether we would advise the removal of a foundry from an urban to a suburban or even rural situation, or again from the North to the Midlands or South. Such questions are exceedingly difficult to answer, without a full knowledge of the present and proposed conditions. Before any sort of reasonable answer can be given, the annual requirements would first have to be determined, such as labour, pig-iron, coke, power, area, sidings and so on. Next there must be an approximation of these costs in the existing and proposed sites plus such figures as rates, depreciation, taxes and the like. Should real advantages now be shown, it remains to estimate the costs directly attributable to moving, such as land, site improvements, cost of transporting machinery and stores, building and so on. After a survey of the cost of marketing at the envisaged sites, a summary can be prepared of the annual savings on the score of operating and distributing, and against it placed the expense of moving. We are sure that it would pay a number of firms situated in some of the older manufacturing centres carefully to prepare such schedules, as some firms would be making a reasonable return on their money but for the incidence of local taxation, whilst for probably ninety-nine out of a hundred foundries there is no need for such considerations, as their business is purely local, but there are cases, such as a foundry we know well, which is situated in one of our large cities and of which the lease expires very shortly. By preparing schedules of the costs of manufacturing in the nearby garden cities, they would be in an infinitely better position to exact reasonable terms from the landlord. The possession of such information by other firms would be valuable in impressing upon local authorities the necessity for a lowered rateable assessment. There is much to be said for arming oneself with a knowledge of what it would cost to manufacture in some other locality.

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Porous Castings.

To the Editor of The Foundry Trade Journal.

Sir,—The tiny pinholes described by "Central Africa" are caused by gas given off during solidification from the hottest part of the casting, which become trapped under the skin due to this part freezing first. It is not until the castings are machined that these defects are discovered. To prevent this great care and attention must be paid to the melting conditions. It is of special importance to see that the metal is hot and thoroughly melted and stirred, before any additions such as Sn, Zn, Pb and so on, are introduced. Do not stir or rotate roughly, but, with a brisk up-and-down motion so as to reach the lowest part of the crucible and in such a manner as if you were about to bring or draw the bottom portion of the metal to the top. Never cast or pour castings of any importance from a crucible with a black bottom, or one that has commenced to leak in the furnace. A good preventive against a cold-bottomed crucible is to place a whole or half firebrick on the bottom of the furnace so as to prevent the crucible from falling below the coke bed.

It often happens that on extracting the crucible from the furnace, the firebrick is found to be cemented to the bottom. To prevent this sprinkle on the surface of the firebrick a small amount of dry sand, borax or powdered glass. When starting from cold or what is known as first melt the crucible should be coked around and brought up to melting point or thereabouts before charging with metal. When ready for charging, replace any burnt-away coke around the crucible, then drop to the bottom by measure one handful (by grip and not heaped up) of salt (Na Cl) and borax, previously mixed in equal parts, and a few pieces of lump charcoal.

Charge on top of this fifty per cent. of the scrap metal followed by two or three ingots of copper; continue in this manner until full. Care must be taken that pieces of metal do not overhang the side or walls of the crucible. This can be prevented to some extent by the use of a sleeve or extension piece cut from an old crucible, inverted and placed lip to lip to the crucible in the furnace. The bottom parts can be used for covers if required.

As melting proceeds and the necessary scrap and copper are used up, a few more pieces of charcoal are thrown on top of the metal when it is seen to fall, or show signs of melting. When thoroughly melted and before adding any mixings, etc., stir briskly and drop in fifty per cent. of the required phosphor copper and stir again until dissolved, then add half of the Sn followed by a small piece of phosphor copper. Add the remainder of Sn and lastly the remaining phosphor copper.

It must be distinctly understood that the metal must be continuously and gently stirred during the introduction of the mixings and deoxidant phosphor copper.

The amount of flux (salt and borax) is ample for fairly clean scrap. When very dirty, painted or oxidised scrap is used, more will be required; also it is good practice to add a few pieces of glass in this case.—Yours, etc.,

G. C. S. P.

August 4, 1932.

American Symposium on Steel Castings.—The Papers presented in the Symposium on Steel Castings, held at the recent annual meeting of the American Society for Testing Materials, in co-operation with the American Foundrymen's Association, are being reprinted in a separate volume, with discussion. The volume will comprise about 250 pages, and it is expected that distribution will commence about October 1.

The Institute of Metals and Iron and Steel Institute.

We have received the following additional information regarding the first joint meeting of the Iron and Steel Institute and the Institute of Metals to be held in London from September 12-15. The business sessions for the reading of Papers will be held in the Halls of the Institution of Civil Engineers and of the Institution of Mechanical Engineers. Visitors tickets for admission to the business sessions can be obtained on application to the Secretary of either Institute, Victoria Street, London, S.W.1.

The opening session will be held in the evening of Monday, September 12, when Dr. H. J. Gough, of the national Physical Laboratory, will deliver the Annual Autumn Lecture of the Institute of Metals on "Corrosion Fatigue in Metals."

In the morning of the following day there will be a joint session at the Institution of Civil Engineers. In the afternoon separate sessions will be held—the Institute of Metals Papers being discussed at the Institution of Mechanical Engineers, and the Iron and Steel Institute Papers at the Institution of Civil Engineers. In the evening a conversazione will be given at the Science Museum, South Kensington, the guests being received by Sir Charles Wright, Bart., K.B.E., C.B. (President of the Iron and Steel Institute) and Sir Henry Fowler, K.B.E., LL.D., D.Sc. (President of the Institute of Metals). A feature of the evening's entertainment will be a display of scientific cinematograph films—both talking and silent. The Band of the Royal Air Force will play during the evening.

In the morning of Wednesday, September 14, final separate sessions of the two Institutes will be held when the remaining Papers will be presented and discussed. Altogether it is expected that 14 Iron and Steel Institute Papers and 17 Institute of Metals Papers will be presented at the various sessions. The remainder of the meeting as previously published in these columns will be devoted to visits to Works and Institutions in the London neighbourhood. On Wednesday evening an informal dinner-dance will take place at the Piccadilly Restaurant.

Iron and Steel Output in July.

The National Federation of Iron and Steel Manufacturers states that there were 56 furnaces in blast at the end of July, 13 less than at the beginning of the month, 8 having been damped down and 5 blown out. The production of pig-iron in July amounted to 292,600 tons compared with 311,400 tons in June and 317,000 tons in July, 1931. Production includes 57,500 tons of hematite, 135,300 tons of basic, 81,600 tons of foundry, and 11,400 tons of forge pig-iron.

The output of steel ingots and castings in July amounted to 430,300 tons, compared with 459,300 tons in June and 428,700 tons in July, 1931.

Rumanian Iron and Steel Cartel.—This Cartel originally consisted of the following three concerns:—(1) Reshitza, (2) Titan-Nadrag-Calan, and (3) the Cluj (Klausenburg) Wire Industry Company. The policy pursued by the Cartel was to squeeze out of the market all dissidents by price undercutting in which they were successful for a time, except in the case of the firm, David Goldenberg & Sons, of Braila. This firm managed to resist the manœuvres of the Cartel for some time by buying foreign semi-products at a low price and importing them in steamers along the Danube, a cheap way of transport. Finally, however, the Rumanian Ministry for Commerce and Industry raised objection to the further importation of semi-products, as ample supplies of these could be obtained in the country itself. This, with the restrictions of transactions in foreign currency, sealed the Braila firm's fate, who finally were compelled to close their works.

Random Shots.

THIS WONDERFUL WORLD.

You may remember that I remarked last week on a Czecho-Slovakian brewery that has paid its dividends in beer. Stranger things than that, if reading is believing, have happened on the Continent quite recently. For instance, the superintendent of a small prison in South-Eastern France has been dismissed because he released the prisoners in his charge "in order to devote himself to writing verse." A town near Warsaw, becoming insolvent, has been sequestrated by bailiffs and is to be sold by auction. A German has set up a world record for pole-squatting by remaining aloft for sixty days.

* * *

And:—A professor and a student in Bukharest fixed up a gallows, placed the rope round their necks and jumped from a chair in order to experience the sensation of hanging. A tobacconist in Rotterdam has been charged with acting as a shilling-in-the-slot machine after closing time. He stood at the back of a dummy machine, and when money was put in the slot supplied the cigarettes. The court decided it was illegal.

* * *

But the Continent has no monopoly of curiosities. One of our own newspapers recently contained this ingenuous paragraph in its "agony column": "Will gentleman sportsman help another sportsman, having permanent job, London, twenty-seven, public school; give £2,000 enable marry loveliest girl in England and save broken romance; possible friendship several interesting and charming young people follow, absolutely genuine, unimpeachable references, urgent."

* * *

And was there not a duel fought between two Americans because when one said of Greta Garbo, "She's God's gift to a stricken world," the other replied, "Bah! I wouldn't cast her in the rôle of a laundry worker." Also a young American girl taking part in a transatlantic flight has announced her intention of doing a parachute jump over Florence, in Italy, in honour of Florence Nightingale. And an Englishwoman has been reported as "wearing a white bathing costume and scarlet toe-nails."

* * *

A woman in a crowded tramcar said "Stop pushing!" to a fat man behind her. The fat man said, "I'm not pushing, I'm sighing."

* * *

Examples of Common Property.

Matches.
Cigarettes.
Umbrellas.

* * *

DOES YOUR KIDDIE YEARN TO BECOME A YO-YO EXPERT?

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Marksman.

Some Factors Affecting the Cleanliness of Steel Castings.*

By C. H. Herty, Jr., C. F. Christopher and M. W. Lightner.

In any discussion of inclusions in steel it must be kept in mind that there are three sources for the entrance of such non-metallic matter. The first source is non-metallic matter in the raw materials charged or added during the working of the heat. The second source is deoxidation, whereby soluble iron oxide is converted into insoluble oxide of manganese, silicon, aluminium or oxides of any other deoxidisers used. The third source is the erosion of the spout, the ladle lining, the nozzle, and, in the case of steel castings, the mould. Inclusions from this third source are rare, when present usually are readily discernible to the naked eye and are in general a minor factor in steel cleanliness.

Elimination of Inclusions During Working of Heat.

In any heat of steel the charge always contains a certain amount of non-metallic matter. This consists mainly of Al_2O_3 and SiO_2. The amount varies widely and depends on the cleanliness of the raw materials used. It has been found[1] that pig-iron varies in cleanliness over exceedingly wide limits. The variation in the cleanliness of pig-iron is so much greater than the variation of cleanliness of scrap that the major variations in the cleanliness of the charge may be traced to the pig-iron rather than to the scrap. There are two ways in which inclusions from the charge may be eliminated during the working of the heat: (1) Intimate contact of slag and metal brought about by proper agitation of the bath, and rapid absorption of the non-metallic matter obtained by proper slag viscosity, together with a long enough time of working, and (2) by fluxing the inclusions by MnO or FeO dissolved in the metal. Low-carbon steels, before deoxidation, are usually lower in this type of inclusion than high-carbon steels because there generally is more iron oxide dissolved in the steel at the lower carbon content.

The silicates in the charge are gradually eliminated from the time the heat is melted until it is ready for deoxidation. An average of 14 heats[1] showed that the average silicate content of the charge was 0.023 per cent. and of the bath before deoxidation 0.009 per cent. These heats were worked from 2 to 4 hrs. between melt-down and tap. If the heat is melted down to the desired carbon and tapped immediately there is little chance of eliminating inclusions originating in the charge. In order to get the best elimination under any conditions, the slag must be at the proper fluidity whether it is acid or basic.

Basic Slags.

In conditioning the slag for the elimination of non-metallic matter, it must be remembered that high FeO confers fluidity, but at the same time causes excessive oxidation of the metal, which may be quite harmful when the heat is deoxidised. If a slag contains too much lime it will be too viscous. Such a slag may be readily thinned out with fluorspar. The use of too much fluorspar is dangerous, for, whereas it takes only a small amount of spar to thin out a slag, a great deal of lime is required to thicken the slag if the heat has been over-fluorsparred. If the slag be too high in magnesia, it is difficult to get it in the proper condition. The slag will be quite grainy and fluorspar will not act upon it as readily as upon high-lime slag. For best results, the magnesia should be kept between 5 and 8 per cent., and the CaO between 40 and 45 per cent. If the slag be too thin, burnt lime or dolomite may be used for thickening, depending upon the MgO content of the slag. For example, if a slag usually contains about 5 per cent. MgO, it is well to use dolomite for thickening, because MgO will thicken the slag more rapidly than CaO. On the other hand, if the slag usually contains 8 per cent. MgO, it is advisable to use burnt lime. The excessive use of fluorspar may be avoided by charging enough manganese as high-manganese pig-iron so that the slag contains from 8 to 10 per cent. MnO.

FeO in the slag is best controlled by carefully controlling the melting-down period and using as little ore as is consistent with speed of working. It is better to melt down rapidly and at a high temperature than slowly at a lower temperature. Reagan[2] has shown the relation between melting down and oxidation of the slag. Viscous slags may be thinned out by an increase in temperature, but it is dangerous to use this method of obtaining the proper slag viscosity, because, if the slags are kept heavy until the proper time for the temperature increase, the time for scrubbing out inclusions in the steel will be too short.

Acid Slags.

The best method of controlling the viscosity of the slag is to use the proper amount of CaO and to regulate the temperature so that not too much silica is picked up from the furnace lining during the course of the heat. By regulating the silica pick-up, the slag may be kept at the proper fluidity until the heat is ready for deoxidation. FeO and MnO are interchangeable so far as viscosity is concerned. It is possible, therefore, to deoxidise the slag without interfering with viscosity, provided manganese is used as a deoxidiser. It is advisable to use a high-manganese charge. This may be obtained from high-manganese pig-iron or from low-manganese pig-iron plus spiegel. When CaO is added to the slag, some of the iron oxide is freed from its combination with silica. The released FeO diffuses into the metal and the total FeO is lowered.

After this step has been taken, it is advisable to add manganese to the bath from time to time as ferro-manganese or spiegel, and thus reduce the iron-oxide content of the slag without interfering with its fluidity. Jacobs and Herty[3] have shown that when spiegel is added with the ore the silicate content of the metal is reduced considerably, on account of the fluxing action of the MnO formed by the oxidation of the manganese in the spiegel. In order to effect the best elimination of non-metallic matter from the acid charge, it is essential that a brisk boil take place throughout the major portion of the working period. This is quite easy to accomplish by the proper use of ore and manganese.

The Deoxidation of Basic Steel.

When the heat is ready for deoxidation it contains from 0.15 to 0.25 per cent. FeO, which must be eliminated to a large extent. If the steel is insufficiently deoxidised, blow-holes will be found in the surface and body of the casting. In order to accomplish the deoxidation it is necessary to use metals which will react with the iron oxide and whose deoxidation products will not react with carbon. The three deoxidisers in common use are manganese, silicon and aluminium, these being given in order of their strength. Manganese alone, unless added in very large amounts, will not prevent the formation of blow-holes; in steel castings it is necessary to use silicon, and in some instances both silicon and aluminium. In order to prevent the retention of the deoxidation products, it always is necessary to use some manganese with the silicon or aluminium.

The best practice in deoxidation is to deoxidise as thoroughly as possible in the furnace and to complete the deoxidation in the ladle. When the heat is deoxidised in the furnace, the deoxidation products (non-metallic inclusions) are more easily eliminated from the metal than if the deoxidation were carried out entirely in the ladle, because there is less distance for the inclusions to rise and enter the slag. If silicon alone be used as a furnace deoxidiser, the silica particles are eliminated quite slowly. If manganese be used in conjunction with the silicon as a separate alloy, much cleaner steel is obtained; and if the two were used as an alloy containing a ratio of manganese to silicon of from 4:1 to 6:1, the elimination is more rapid than with either of above-mentioned methods. The reason for this is that much larger particles are formed on deoxidation, and the larger the particle the more rapid its rise through the metal bath. The rate of rise of particles of different size is given in Table I. From this table the importance of forming a large particle can be readily seen.

TABLE I.—*Rate of Rise of Inclusions.*

Size of inclusion, cm. × 10^4.	Maximum rising velocity, in. per min.	Least time required to rise through, in minutes.	
		30-in. open-hearth bath.	12-ft. ladle.
5	0.061	432.0	2360.0
10	0.245	122.0	587.0
50	6.12	4.93	23.60
100	24.45	1.22	5.87
500	612.00	0.05	0.24

Whilst silicates are being eliminated from the furnace, iron oxide is diffusing from the slag into the metal. If the heat is kept in the furnace too long after deoxidation, the work of this deoxidation will have been nullified by the rise in the FeO content of the metal. If 0.10 per cent. of silicon is added to the bath as silicon pig or as a silicon-manganese alloy, from 10 to 15 min. are required for the elimination of the silicon. As soon as the silicon is eliminated, the iron oxide content of the bath begins to build up, as shown in Table II. Zero time is taken when the silicon content of the metal has reached 0.01 per cent. The depth of bath in these heats was 24 in. If the non-metallic particles are of such a form that they are very slowly eliminated, it is obvious that FeO in the metal will be high before complete elimination occurs. On the other hand, if the proper proportion of deoxidisers be used, the non-metallic particles can be eliminated in from 10 to 15 min. and the heat should then be tapped immediately, else the FeO in the metal will rise as shown in Table II.

TABLE II.—*Increase of FeO in Metal after Silicon Elimination.*

Heat No.	Time in minutes.	FeO in metal, per cent.
1396	0.0	0.119
	2.5	0.122
	5.5	0.155
	8.0	0.160
	11.0	0.165
	13.0	0.205
2105	0.0	0.102
	4.0	0.123
	8.0	0.137
	11.5	0.202

During the deoxidation period the slag should be reasonably heavy, in order to prevent too rapid reoxidation of the metal. It often is true

* Extracted from a Paper presented at the Detroit meeting of the American Foundrymen's Association, by the authors, who are on the Metallurgical Advisory Board of the Carnegie Institute of Technology.

1 U.S. Bureau of Mines, "Bulletin No. 308, 1929."

2 American Institute of Mining and Metallurgical Engineers, "Technical Publication No. 469, 1932."

3 "Transactions," American Society for Steel Treating, vol.19, No. 3, p. 271, 1932.

that when the heat is deoxidised, the slag tends to thin out on account of the SiO_2 and MnO which enter from the metal, and from the increased temperature resulting from the deoxidation. In such a case, it is best to add dolomite or burnt lime, depending upon the magnesia content of the slag. Particular care should be taken to prevent any action at the ends of the furnace, and a few shovels of dolomite on each end after the dexidisers are added usually is sufficient to prevent rapid reoxidation of the metal. After the heat is tapped, the additions are added in the ladle to make the final specifications and to complete deoxidation. If aluminium is used in the ladle it should distributed as well as possible and not added all at one time. If the aluminium is not distributed, the proper effect on degasification is not obtained and very great segregation of alumina is apt to occur.

Deoxidation of Acid Steel.

The deoxidation of acid steel, either open-hearth or electric, is in general much simpler than in basic steel because the slag can be controlled to a much greater extent. For example, by the proper use of manganese during the working of the heat the iron oxide in the slag may be reduced to a low value. Acid open-hearth slags worked without manganese will give the following average analysis: FeO 17 per cent., MnO 20 per cent., SiO_2 56 per cent., CaO 4 per cent. Heats worked with manganese show average analyses of FeO 12 per cent., MnO 25 per cent., SiO_2 56 per cent., CaO 4 per cent.

By reducing the amount of FeO in the slag from 17 per cent. to 12 per cent., it is possible to slow down greatly the diffusion of iron oxide from slag to metal, thereby minimising reoxidation after the deoxidisers are added. Furthermore, when the FeO is lowered to 12 per cent., enough silicon is reduced into the metal so that very little extra must be added to meet the final specifications. The necessary silicon may be added as ferro-silicon or as a silicon-manganese alloy. If 0.08 per cent. or more silicon is to be added, it is preferable to add a silicon-manganese alloy. Otherwise, ferro-silicon may be added without the danger of the formation of very many silica particles. All deoxidisers, except any aluminium necessary, should be added in the furnace.

Inclusions in Cast Steel.

There are two general types of inclusions in cast steel, the oxide and the sulphide. The oxides include silicates and Al_2O_3. Inasmuch as oxides and sulphides are mutually soluble in the liquid state, there is almost always some oxide in a sulphide inclusion and, conversely, some sulphide in oxide inclusions. Aluminium silicate and Al_2O_3 usually occur in small clusters which are sometimes found around the grains and sometimes within the grains. Silicates are present as globules and are to be found located either in the grain boundaries or within the grain itself. In the liquid steel the silicates may be quite small, but they coalesce when sufficiently concentrated to form larger globules.[6] The growing crystals push the small particles ahead until free crystallisation sets in, when the inclusions are trapped wherever they may be at this time. Concentration of silicates at the point of free crystallisation is shown in the data for an ingot[7] as given in Table III.

Al_2O_3 acts in much the same way, except that the segregation is not so marked.[7] Therefore, the type and concentration of silicates and Al_2O_3 depend upon the size of the castings and the amount present in the liquid steel immediately before the metal is cast. If no manganese be present, FeS alone can precipitate; and it is well known that this sulphide is exceedingly soluble in liquid steel. Therefore, it is not precipitated until very high concentrations are reached, and this can occur only when almost all of the steel at any given point has solidified. The sulphur, therefore, would be found as FeS, or as the eutectic of Fe and FeS, entirely in the grain boundaries except for that in solid solution. As the sulphur precipitates at the last moment of crystallisation, there is no opportunity for coalescence into globules. The inclusions therefore appear as thin bands surrounding the grains.

Table III.—*Heterogeneity of a Steel Ingot.*

Position.	Sample No.	% SiO_2.
Skin of ingot	1	0.017
	2	0.019
	3	0.016
	4	0.019
	5	0.020
	6	0.026
Change of crystallisation from dendritic to equiaxed.		
	7	0.057
	8	0.095
	9	0.023
	10	0.031
Centre of ingot	11	0.024

The difference in the appearance of FeS and MnS-FeS complexes is attributable, therefore, to differences in solubility. If one postulates that additions of aluminium increase the solubility product (per cent. Mn times per cent. S), or increase the solubility of sulphur for a given manganese content, with the possible formation of aluminium sulphide or complexes with manganese and iron sulphide, it gives a ready explanation of the effect of aluminium on the form in which sulphur exists in steel castings. An increase in solubility means that the sulphide will be thrown out of solution later in crystallisation and that the sulphur will necessarily appear in the grain boundaries in very small globules. The volume of mother liquor between crystallites is too small to allow growth of the inclusions by coalescence.

Sims and Lilliqvist[8] have clearly shown the effect of the type of inclusion on the ductility of steel castings. They attributed the dispersion of particles in cast steel to lack of FeO and MnO in the metal. Although this may be true to some extent, it is improbable that the small variations in FeO due to an addition of 0.03 per cent. aluminium would change the solubility of sulphides to any marked extent. Variations of from 0.06 to 0.20 per cent. silicon and higher, with an attendant decrease in FeO in the metal, have no effect on the form of the sulphides. Unquestionably, there are variables other than the form of the inclusion which affect the physical properties. For example, the amount and composition of the ferrite in a normalised test control certain physical properties such as impact strength.

From the above considerations it is obvious that if the aluminium must be used to ensure sound castings, only two courses can be followed to eliminate the sulphide films resulting from its use:—(*a*) The manganese content may be made so high that, in spite of the increased solubility of the product, the sulphur is precipitated as small globules with sufficient time and space for coalescence to take place. This course would require such high manganese contents that the physical properties of the metal would be quite different from present-day castings; and, more important still, the cost would be enormous, and (*b*) if the sulphur content of the steel could be lowered sufficiently, no sulphide envelopes would be found after deoxidation with aluminium. This method would appear to be quite feasible.

Elliott[9] has shown that pig-iron may be desulphurised rapidly and completely in the basic electric furnace. The desulphurisation of the pig-iron in a steel-casting plant with rotation of a considerable proportion of its own scrap would soon result in castings containing not more than 0.012 per cent. sulphur, and this should be sufficiently low to entirely prevent sulphide envelopes around the grains even though aluminium was used in the castings. At the present time, the metallurgical advisory board to the Carnegie Institute of Technology is investigating the economics of pig-iron desulphurisation. A low-sulphur steel combined with the best practice in slag control and deoxidation should enable the steel foundryman to produce a product of superior and more uniform physical properties.

6 "Co-operative Bulletin No. 36," U.S. Bureau of Mines, Carnegie Institute of Technology, and Metallurgical Advisory Board.

7 "Transactions." American Society for Steel Treating, vol. 19, No. 1, p. 1, 1931.

8 Sims, C. E., and Lilliqvist, G. A., "Inclusions, Their Effect, Solubility and Control in Cast Steel"; A.I.M.E. "Technical Publication No. 453."

9 "Foundry," September 15, 1921, vol. 49, p. 714, Foundry Trade Journal, September 22, vol. 29, p. 236.

District Presidents.—No. 2.

LANCASHIRE BRANCH OF THE INSTITUTE OF BRITISH FOUNDRYMEN.

Mr. Ellis Flower, the new President of Lancashire Branch, was born in Sheffield in 1890, and entered Messrs. Hadfields, Limited, Sheffield, as office boy in 1903, with which firm he subsequently served his apprenticeship under the supervision of Mr. Wm. Turner, foundry

Mr. Ellis Flower
(*Chairman of the Lancashire Section of the Institute of British Foundrymen.*)

manager. He left Sheffield in 1911 to enter the employment of Messrs. Beyer & Peacock, Limited, Manchester, where he stayed for about 5 years, after which he started on a tour of the country in search of a wider and more general knowledge of foundry work, after several years of which he finally settled at Messrs. Arthur Lowcock & Company, Limited, Shrewsbury, where he had control of their three Coleham foundries and pattern shop, and where after 2 years he again returned to Manchester to take up a similar position with Messrs. The Vaughan Crane Company, Limited, with which firm he has been for the past 9 years. Mr. Flower now teaches foundry work at the New Manchester Openshaw Junior Technical Schools, which, amongst other engineering equipment, has a fully-equipped foundry, complete with cupola, crucible furnace, moulding floor, moulding and core benches, etc.

Mr. Flower became a member of the Institute of British Foundrymen in 1921, and has taken a very active part in the work of the Lancashire Branch, especially anything appertaining to the welfare of the younger entrants to the industry.

Moulding and Runner Boxes.

By G. Longden.

Many flaneurs are inclined to imagine that moulding is becoming more simplified every day. It is hard to determine from what sources these convictions arise. Blocking out portions with cores is given as a reason; but the time has long passed since this idea was put into practice, and where any advantage can be obtained to simplify or expedite output cores should be substituted where drawbacks or dangerous portions would be a disadvantage. Taking the production of the casting, which is given as an example in this article, it would be difficult to call to mind a more complicated or difficult undertaking for the jobbing founder.

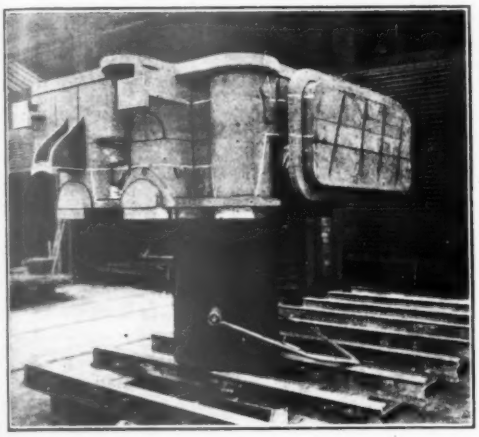

Fig. 1.—Pattern for a Cylinder Combination. It is 8 ft. 6 in. Long.

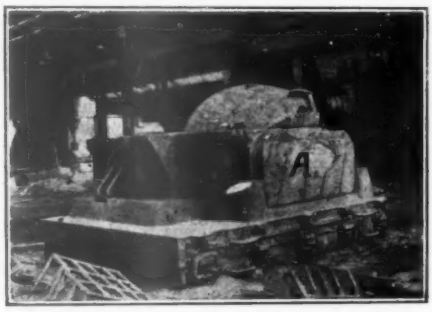

Fig. 2.—Mould in Progress.

Fig. 1 shows a view of the pattern, measuring approximately 8 ft. by 6 ft. by 3 ft. deep; it is quite small but compact; and where visible the drawbacks are marked. There were 17 drawbacks in all, but these included drawbacks in drawbacks. The whole of the cores and mould were made in loam; for the mould and for 60 per cent. of the cores the loam consisted of:—18 parts of old sand, 4 Erith loam, 1 red sand, 1 manure and 1 part of cowhair. The remaining 40 per cent. of cores were made with a loam consisting of:—18 parts of old sand, 7 Erith loam, 3 red sand, 6 sea sand, 6 blacking, 1½ manure and 1 part of cowhair. The latter mixture, it will be noted, is considerably strengthened by the addition of new sand, but extra porosity is obtained by the addition of sea sand.

A Useful Loam Mixture.

Although the bond is not reduced by the blacking content, it is this which is the governing factor in removing the cores which are not easily accessible for the dressers. The advantages of this mixture are:—(1) A strong reliable core, (2) good porosity, (3) suitable for joining vents, (4) easily repairable if damaged, (5) will stand any quantity of metal and (6) will run from the casting as easily as any oilsand core.

These were some of the reasons why the cores were all made in loam, but there is another important factor to be considered, and that is the personnel available.

A coremaker who has 85 vents to remember would soon become confused if he had first an oilsand core and then a loam core to deal with, and there would be no degree of safety.

Fig. 2 shows the mould in progress. The bottom part of the mould has been formed with a double boxpart, so as to allow for a good bed of ashes, which were led out to each corner of the box. Part of the drawbacks will be seen on the left of Fig. 2, and the amount of mould which could be left standing round the exhaust core at "A." The remainder of the mould to the top was formed in the middle part.

Fig. 4.—Showing the Cores Neatly Set.

Fig. 3.—Bottom Part ready for Coring.

Fig. 5.—Gating Arrangements.

Fig. 3 shows the bottom part ready for the commencement of coring and at "B" the delicate portion between the bottom flange and the main exhaust core; Fig. 4 gives a view of part of the cores in position with drawback

Fig. 6.—Showing the Middle Part in Position.

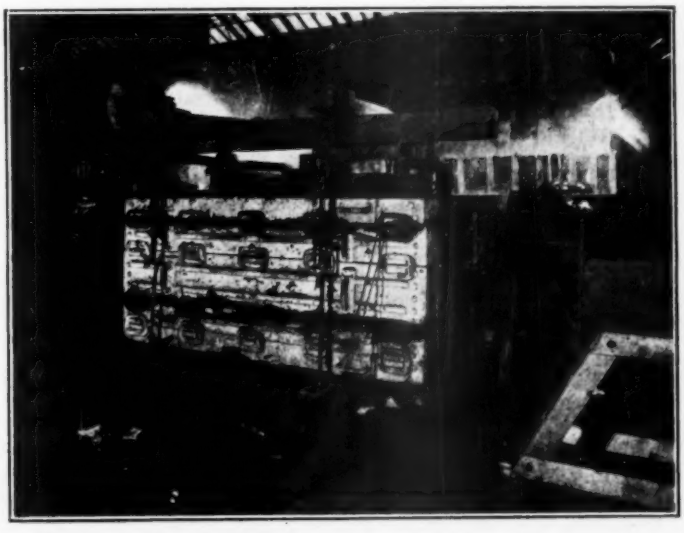

Fig. 7.—Showing the Casting of the Mould.

"C" made ready to receive the main drawback on joint "D"; and Fig. 5 shows the same progress: no further coring has been done.

Gating Considerations.

It can be readily imagined that the success of obtaining a sound casting depended mostly upon the gating and pouring of this mould. Whilst the mould is only half cored up, the numerous walls causing obstruction to the metal can be plainly seen; it will also be noted that a minimum amount of chaplets were used, and these of the single type. This was to ensure less chance of leaking walls, which, needless to say,

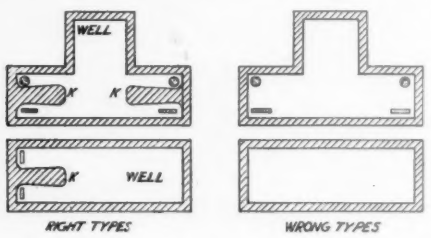

Fig. 8.—Runner Boxes of Correct and Incorrect Types.

would have resulted in a rejected casting. The gating consisted of two 1¾-in. round downgates dropped on the bottom joint to the left at "E" (Fig. 5). From these, sprays were cut into every possible space in the bottom flange. The area of these sprays together were constructed in such a way so that they would take approximately twice the volume of metal as the downgates. The reason for this was that, instead of having a rush of metal directed on a confined space, there was a steady, yet quick, flow, which allowed the metal quickly to find its own level. Twenty seconds after these downgates were opened, which ensured a cushion of metal in the

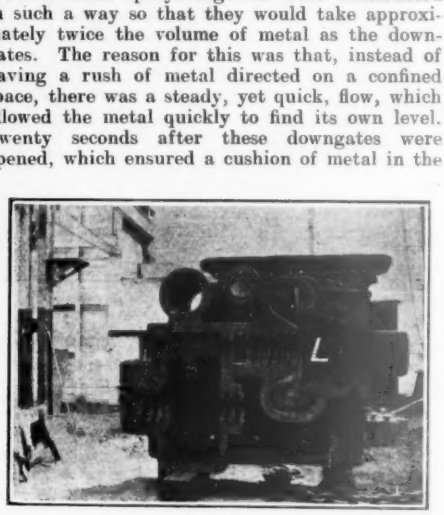

Fig. 9.—The Finished Casting.

mould, two dropgates measuring 3 in. by ¾ in. and directed down the side of the gear case at "F" (Fig. 5) were opened in the same runner box, simultaneously with this; pouring took place at the other end by means of two dropgates, measuring 3 in. by ¾ in.

These latter gates were directed so that the metal dropped immediately into the bottom of the cylinder portion at "G G," thus ensuring no dross or sulage being trapped in a most vital part. From the drawing of the first plugs to the metal entering the risers only 67 seconds elapsed. The metal was taken immediately from the cupola and poured as hot as possible. The composition of the metal was:—Total carbon, 3.58 per cent.; combined carbon, 0.58; silicon, 2.07; manganese, 0.57; and phosphorus, 0.95 per cent. There is nothing extraordinary in this composition, excepting the phosphorus: this was purposely high to ensure a good fluid metal, for whilst the casting is not subject to high pressure, all the walls must be perfectly oiltight.

Proceeding with the closing, Fig. 6 shows a view of the middle part in position with the gear case at "H" and the main exhaust core at "J" ready to receive the bedplate and other cores, and Fig. 7 is the cast taking place.

The holding-down bars were not made specially for this job, but were used on most of any size. They were very useful, however, for this cast, as boxes of this size are not dependable when the full buoyancy of the metal is at its culminating point, and had there been the slightest movement of any of these cores it would have been fatal. The bars ensured a rigid and immovable structure. Fig. 8 shows types of runner boxes.

After all precautions have been taken, one thing is often lost sight of—that is, the construction of the runner boxes. Considerable trouble may arise from this source. It is often wondered how dross or dirt has found its way into the casting, although there are no visible reasons for it. The runner boxes are the cause. If they are constructed in such a way so that the metal is allowed to circle round the downgates, the latter will act like a whirlpool, and all dross is sucked down and into the mould to be trapped in some vital place. Obstruction should take place as shown at "K K" (Fig. 8), so that the downgates are in a con-

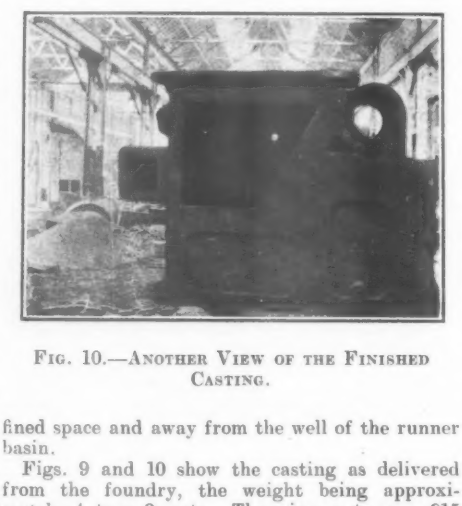

Fig. 10.—Another View of the Finished Casting.

fined space and away from the well of the runner basin.

Figs. 9 and 10 show the casting as delivered from the foundry, the weight being approximately 4 tons 9 cwts. The piece rate was £15 moulding and closing and £15 cores, and a percentage was made of: *Cores*, 45 per cent. bonus; and *Moulding and closing*, 47 per cent. bonus.

Chilling.

Chilling was also a special consideration in this casting, and all corners of cores, where subject to fillets, were formed by a suitable chill fastened in the core; also small chills were built in the cylinder core at "L," Fig. 9. This latter section of metal was 1¾ in. thick, being the only variation in the casting of a uniform thickness of ⅞-in. metal. A series of these castings were produced by Messrs. C. A. Parsons, Newcastle-upon-Tyne, during 1931, and are called "cylinder combinations." They are almost a complete turbine in so far as castings are concerned, and consist of cylinder, gear case, bedplate, oil strainer, etc., in one casting.

British Association.—Provisional plans are now announced for the annual meeting of the British Association at York. The meeting will be held from September 3 to September 7, and the President this year is Sir Alfred Ewing, who will deliver an inaugural address on "An Engineer's Outlook." Other arrangements include the presidential address in the Section of Mathematical and Physical Sciences, to be given by Prof. A. O. Rankine on "Physics in Prospecting for Minerals." There will be Papers in the Section of Economic Science and Statistics on the location of industries, the effects of the world depression on the banking systems of Central Europe, and the economic position of Japan. The address of the section president, Prof. R. B. Forrester, will be on "British Access to Oversea Markets."

A Record Oil-Sand Core?

We illustrate below an oil-sand core made in the foundry of Messrs. Craven Bros. (Manchester), Limited, for building into a mould for

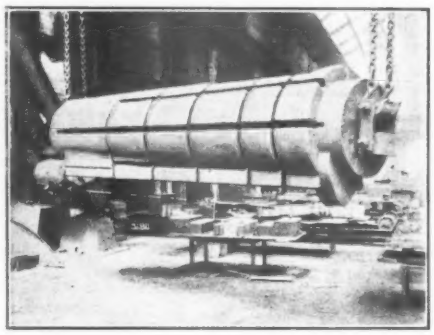

Fig. 1.—An Oil-Sand Core Weighing 5 Tons and Measuring 13 ft. in Length.

a large horizontal boring machine casting. It weighs 5 tons and is 13 ft. long. Can any of our readers show a larger one than this made in oil sand?

Tin-Plated Cast-Iron Pistons.

According to the "Iron Age," a large majority of the cast-iron pistons used by General Motors in all its car models are now given a coating of tin and that one or two other American automobile producers have also adopted the practice.

The object of this development is a reduction in the coefficient of friction between the piston and the wall of the cylinder, especially in new engines. The tin plate produces a better running surface. The amount of tin is very small, the general practice, as thus far developed, being to limit the thickness of the tin plate to not more than 0.001 in. Usually the coating is about 0.0005 in. The pistons are placed in an electrolytic plating bath in which the tin coating is applied according to standard electroplating methods. The cost is claimed to be small and more than justified by the results.

One of the major annoyances of the purchaser of a new automobile is the fact that, for the first 1,000 miles or so, the speed must be kept down to a moderate pace so as not to harm the engine. It is pointed out that the tin plating of cast-iron pistons largely eliminates this drawback—it is not necessary with such pistons to "run in" the engine so long and a new car can be run faster from the start. While some of the tin plate is worn off at points of high pressure after the first 1,000 miles, the benefit of the coating of tin still remaining is decidedly noticeable.

The automobile industry is rated as the second largest consumer of tin. Should the practice of tin plating cast-iron pistons increase, it will mean, of course, a still larger consumption of tin by this industry, easily made possible at the present low market prices of the metal.

Life of Cast-iron Pipe.—Over 70 years ago the City of Providence, R.I., in the United States, laid about two miles of 36-in. cast-iron pipe purchased from the Warren Pipe & Foundry Company of that day. The actual laying took place from 1870-1874. In 1930 this line was abandoned as other mains took its place. Recently a new intake pipe line was decided upon and the Providence engineers decided to dig up the old line. They discovered the pipe in such excellent condition that they determined to use it in the new main, and it is at present being relaid.—"American Metal Market."

The Influence of Design on Brass and Bronze Castings.*

By Lewis H. Fawcett.

Engineers responsible for the design of castings required in engineering projects give careful consideration to the composition of the alloy selected and its mechanical properties, with sufficient allowance for the proper factor of safety. However, in many instances this same consideration has not been given to the foundry problems involved in the production of the casting, and their influence on the ultimate value of the casting. Unfortunately, reliable data on this subject are not always readily obtainable in concise form for the use of designers. It is the purpose of this Paper to outline briefly some of these problems and to prevent some simple illustrations of good and poor design for brass and bronze castings. In the selection of an alloy, consideration should be given not only to meeting the requirements of the design but also to aid production and minimise foundry difficulties. When possible, an alloy should be selected permitting the use of a minimum amount of gates and shrink heads to obtain the maximum yield from the metal melted. A brass with high shrinkage may have a low intrinsic value and yet have a high manufacturing cost, due to the excess metal needed for heads and gates and the additional moulding necessary when using such an alloy. Such a brass would have a tendency to form scurf on its surface; but, in general, it would have a fairly uniform grain size so that the interior metal would about equal the surface metal in soundness.

A bronze would give a smooth, even, close-grained surface of uniform pleasing colour and be produced with less moulding labour and less excess metal in heads and gates. The bronze casting, however, probably would have a relatively coarse-grained interior structure as compared with the structure of the casting's exterior surface.

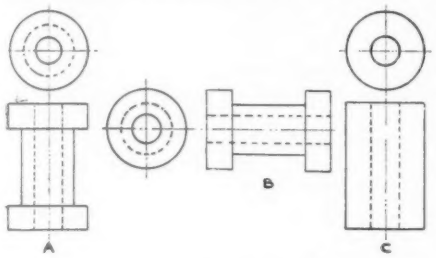

Fig. 1.—Designs of Simple Bronze Cylindrical Bushing.

(*A*) Probable casting position with shrink on top of flange. Some shrinkage is to be expected in flange. (*B*) If large amount of metal is removed in machining, this would be preferred pouring position, as compared with (*A*). In position (*B*) heads would be located on top of both flanges. (*C*) Preferred design for bushing to be poured of a high-shrinkage brass or manganese bronze.

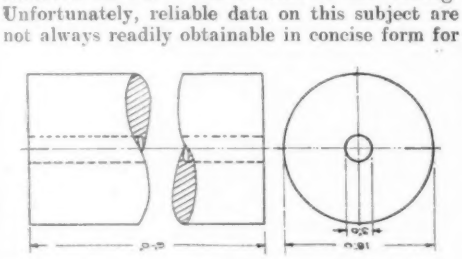

Fig. 2.—Exaggerated Example of Casting that would be Made more Satisfactorily of Brass than of Bronze.

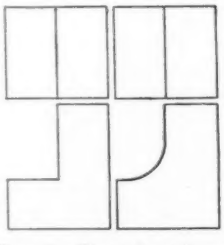

Fig. 3.—Poor (left) and Good (right) Design of Intersections.

* Extracted from a Paper presented at the Detroit meeting of the American Foundrymen's Association.

Table I gives the composition and mechanical properties of two well-known bronzes, and similar information regarding brass is shown in Table II.

Bronze Cylindrical Bushing.

The cylindrical bushing shown in Fig. 1, if made of bronze, in all probability would be cast in a vertical position, as shown in A of Fig. 1. The shrink head would be placed on the top flange. This, of course, does not give ideal conditions during solidification, as the metal must feed the bottom flange through the relatively thin cylinder. The thin section would solidify before the bottom flange and thus cut off the supply of liquid metal during the latter part of the freezing period of the bottom flange. Nevertheless, this procedure would result in a satisfactory casting, and if too much metal was not removed in machining, the casting would withstand a high hydrostatic pressure.

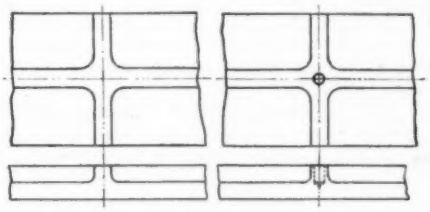

Fig. 4.—(Left) Rib Intersection of Poor Design. (Right) Better Design of Rib Intersection.

If, on the other hand, a large amount of the fine-grained surface metal was removed by machining, it probably would leak (under water pressure) at the junction of the side wall and bottom flange, due to the relatively coarse-grained interior metal allowing the water to seep through. By surface metal is meant the metal in contact with the sand; the interior and exterior of the cylinder would be alike in this respect. To ensure more perfect feeding the cylinder may be cast horizontally, as shown in B of Fig. 1. In this case a head would be located on top of each flange. The thin body of the casting would solidify before the end flanges, but liquid metal

Table I.—*Composition and Mechanical Properties of Bronze.*

Chemical Requirements.

Navy Department Specifications.	Composition.	Cu Per cent.	Sn, Per cent.	Zn, Per cent.	Pb, Per cent.	Fe, max. Per cent.	Ni, max. Per cent.	P, Per cent.	S, max. Per cent.	Sb, max. Per cent.	Other Elements, max. Per cent.
Phosphor Bronze 46–B–5f	Desired ..	88.0	8.0	4.0	0	0	—	0	0	0	0
	Permissible	85.0–89.0	7.5–11.0	1.5–4.5	0–1.0	0.25	0.75	0.5	0.05	0.25	0.35
Gun metal 46–M–6e	Desired ..	88.0	8.0	4.0	0	0	—	0	0	0	0
	Permissible	86.0–89.0	7.5–11.0	1.5–4.5	0–0.30	0.10	0.75	0.05	0.05	0.25	0.15

Mechanical Requirements.

Navy Department Specifications.	Tensile Strength in lbs. per sq. in., minimum.	Elongation in 2 in., minimum.
Phosphor bronze 46–B–5f ..	35,000	18.0
Gun metal 46–M–6e	40,000	20.0

Table II.—*Composition and Mechanical Properties of Brass.*

Chemical Requirements.

Navy Department Specifications.	Composition.	Cu, Per cent.	Zn, Per cent.	Pb, max. Per cent.	Al, max. Per cent.	Mn, max. Per cent.	Fe, max. Per cent.	Sn, max. Per cent.	Other Elements, max. Per cent.
Naval Brass 46–B–10d	Desired ..	62.5	36.3	0	0.2	—	0	1.0	—
	Permissible	60.0–65.0	†	0–1.0	0.5	—	0.5	0.5–1.5	—
Manganese Bronze 49–B–3c*		55.0–60.0	38.0–42.0	0.20	1.50	3.50	0.40–2.00	1.50	0.20

Mechanical Requirements.

Navy Department Specifications.	Tensile strength in lbs. per sq. in., minimum.	Elongation in 2 in., minimum.
Naval brass 46–B–10d	30,000	15.0
Manganese bronze .. 49–B–3c*	65,000	20.0

* A high-test brass. † Remainder.

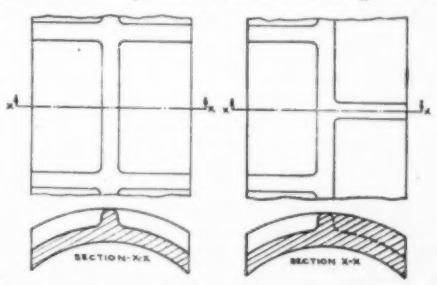

Fig. 5.—Example of Staggered Ribs Designed to Avoid Intersections.

in the head would be available for feeding the flanges during the whole time of their solidification. If the casting were as simple as the one shown in the sketch, it could be cast in this manner. However, many castings which involve these principles have a much more complicated contour, and it is more practical to pour them in a vertical position.

Brass Cylindrical Bushing.

If the bushing were to be made of brass or manganese bronze (a high-shrinkage brass), it

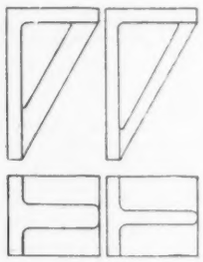

Fig. 6.—(Left) Bracket Support is too Heavy, causing Weakness due to Uneven Metal Section. (Right) This Fault Corrected.

would be more satisfactory to pour a hollow cylinder as shown in C of Fig. 1. This method would insure perfect feeding, as the casting is of uniform thickness throughout. Furthermore, it would allow the dross to rise and collect in the

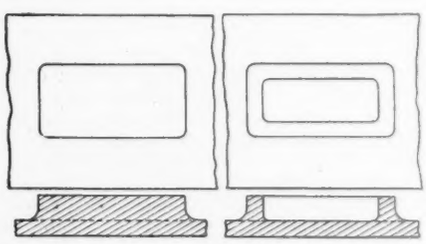

Fig. 7.—Poor (left) and Good (right) Design for Bolting Plates or Pads.

shrink head above without any tendency to be trapped in corners. The cylinder then could be machined to the contour of the bushing. The machining would remove any scurf that might be present on the surface and would not affect the ability of the casting to withstand hydrostatic pressure because the metal does not have

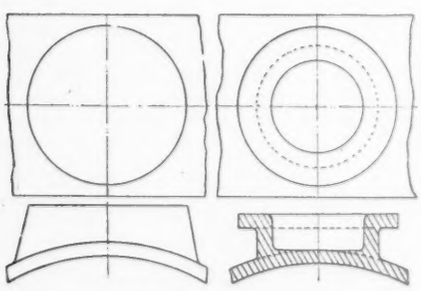

Fig. 8.—Equalising Sectional Thickness by Coring Out.

a tendency to form a relatively coarse-grain interior, as compared with bronze. Considering all the factors involved, it probably would be more economical to make this bushing of bronze rather than of brass—especially so where the casting is required to withstand water pressure.

Considerations in Selecting Proper Alloy.

Fig. 2 shows an exaggerated example of a casting that would be made more satisfactorily of brass than of bronze. The casting is 18 in. in diameter, 6 ft. long and has a 3-in. diameter hole which is to be cored out with sand. The result is a large volume of metal surrounding a small area of sand. The metal is, in turn, surrounded by the refractory sand of the mould which, of course, retards its rate of cooling. If this job were made of bronze there would be a tendency for " tin sweat " to penetrate the sand core, making the removal of the core extremely difficult and resulting in a hard, irregular surface within the hole. Tin sweat is hard and difficult to machine. It frequently has a tin content of about 20 per cent. but may run higher or lower than this figure. Other things being

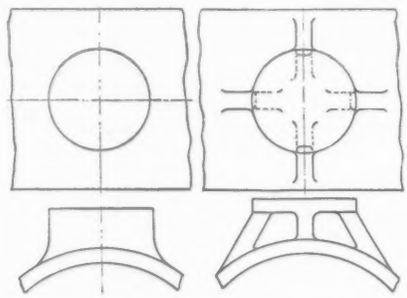

Fig. 9.—Poor (left) and Good Design (right) of Bolting Pads on Cylinder.

equal, the higher the tin content of the bronze, the greater the tendency to form the sweat.

Uniformity of Cross-Sectional Area.

The ideal casting should be designed to have the same cross-sectional area throughout at the time of pouring. Of course, such uniform thickness is not to be expected in most castings, but should be provided wherever practical. At times the allowance for machine finish may cause non-uniformity, although the final machined article may be uniform. When uniform cross-

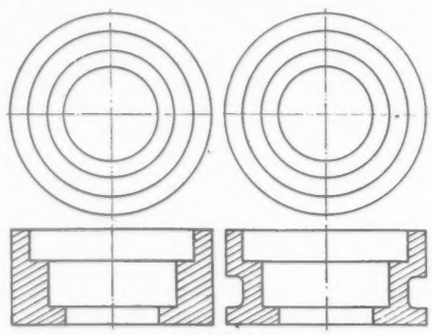

Fig. 10.—Example where Greater Strength is obtained by Lightening Casting, as shown on Right. Original Design on Left.

sections are not possible, an abrupt change from one cross-section to another should be avoided by the liberal use of fillets, which will eliminate right-angle bends and sharp corners and greatly aid in the production of sound castings. Wherever sudden changes in section occur, the lighter section may have completed liquid shrinkage and solid contraction started, whereas the heavier section may still be in the liquid shrinking status, resulting in a rupture or strain at the union of the two sections if proper fillets or brackets are not employed at their intersection.

When it is necessary to attach lugs, bosses, brackets or other projections to the body of a casting, uniformity of metal should be maintained as far as practical, even though it requires the coring out of such projections. An intended solid boss, attached to the casting, may be weaker than a lighter boss that has been cored out, but is entirely sound. Uniform cross-section, the proper use of fillets, rounded corners, coring of heavy lugs and bosses, the avoidance of sharp corners and right-angle bends are details of design that greatly aid in the manufacture of sound castings.

Co-operation of Designer and Foundryman Recommended.

Furthermore, in the interest of sound castings it is essential that the designer visualise the

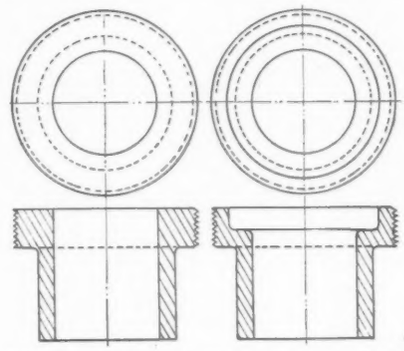

Fig. 11.—Showing how by Coring Out Uniformity of Section is Achieved.

various moulding methods applicable to his design so that he may make modifications which will permit the proper feeding of all the principal parts of the job, or which will result in lightening the casting. If the designer does not have sufficient knowledge of moulding practice for such a survey, it is strongly recommended that he consult a foundryman and obtain his suggestions in the interest of soundness, prior to the completion of the design. Conferences between those producing castings and the designer often have resulted in the production of some very difficult and intricate castings which otherwise might have proved a failure.

Importance of Proper Draft.

Frequently, patternmakers are reluctant to put ample draft on patterns when the drawing shows straight sides and the patternmaker does not know whether draft would affect the finished product. When possible, the drawing should specify a taper or authorised draft. Sufficient

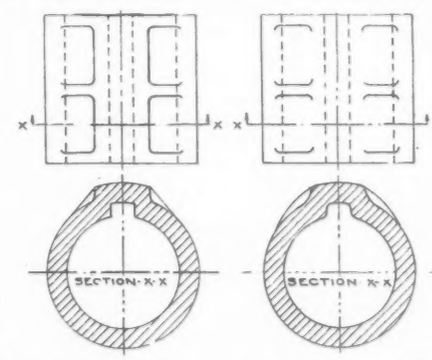

Fig. 12.—Poor (left) and Good Design (right) of Key-Way.

draft will aid in the removal of the pattern from the sand without undue rapping, with the result that the sand will remain firm and thus obviate inaccuracy in the dimensions of the casting. Proper draft results in the casting being a truer replica of the pattern, decreases losses due to mould troubles, and is one of the largest factors in increasing production.

Examples of Good and Bad Design.

The accompanying sketches and photographs give some examples of good and bad design of

brass and bronze castings. Fig. 3 shows the intersection of two members of equal thickness. The sharp corner shown in the poor design (at the left of the drawing) should be eliminated by a gradual tapering from one section to the other, as shown in the good design to the right. At times the tapering may take the form of only a small fillet to avoid the right-angle bend, but in any event it will greatly aid in the elimination of stress concentration at such an intersection and is most essential at the junction of thick and thin sections. In Fig. 4 a too-liberal use of fillets at the intersection of ribs has caused an increase in the width of the inter-

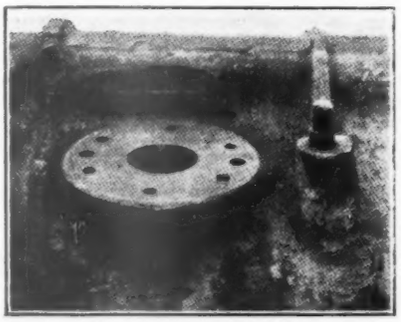

Fig. 16.—Good Design with Round Flange in Centre and Small Boss to Right.

section, and thus has caused non-uniformity at this point. This may be overcome, as shown on the right of the drawing, by coring out the centre of the intersection down to the body of the casting.

Fig. 5 gives an example of staggered ribs designed to avoid intersections. The fillets also are slightly reduced. The diagonal bracket shown as poor design in Fig. 6 is a common error. The bracket has been made larger than the adjoining metal to add strength to the casting, but it has quite the opposite effect. The two sides of the triangle will solidify before the hypotenuse and thus enter the solid contracting stage with a tendency to shrink away from the thicker member before the latter is completely solid. The bracket should be of equal thickness whenever possible, as shown at the right of the drawing. Fig. 7 shows poor and good design for bolting plates or pads. Such projections should be cored out so that the cross-section of these members will be as uniform as possible with the body and thus avoid unnecessary increases in local thickness.

Fig. 8 gives another illustration of coring out of a projection to maintain, as far as possible, equal thickness of metal. The lug is changed to a flange in this case. Fig. 9 shows a great reduction in metal thickness by modification of design without decreasing the bolting or bearing surface of the projection. In Fig. 10 uniform cross-section is obtained by coring out a section around the lower circumference of the casting. This also results in lightening the casting. Fig. 11 gives an illustration of a threaded collar on the end of a casting causing non-uniformity of metal. Uniform thickness of metal is obtained as shown on the right of the drawing. Fig. 12 shows a rectangular key-way with sharp corners and angular ribs. This design may be improved by substituting a rounded ridge over the key-way and easy-rolling ribs, as given to the right of the drawing. A very slight fillet also may be inserted in each sharp corner of the key-way.

An Example from Practice.

The large bronze casting illustrated by the photograph shown as Fig. 13 is the result of co-operation between designer and foundryman, and represents a practical example of the principles previously mentioned. The casting has a large flange on each end and many projections on its body. Attention is directed especially to the coring out of the interior of the large flange visible in the foreground of the photograph. Figs. 14, 15, 16 and 17 give details of this casting or examples that would be applicable to such a design. In Fig. 14 note the care taken to avoid inequalities of section on the projections shown.

Fig. 15 shows a large rectangular flange, in the centre of the picture, which has been carefully cored out below. Note also the easy-rolling ribs and the rounded ridge extending the width of the photograph. This ridge is the outer and top surface of a key-way on the interior of the castings. Fig. 16 shows a round flange in the centre of the picture, with a small boss on its right. The last photograph, Fig. 17, is a close view of a large bolting pad, and attention is particularly called to the coring out of this projection and to the fact that sharp corners were avoided in accomplishing this modification.

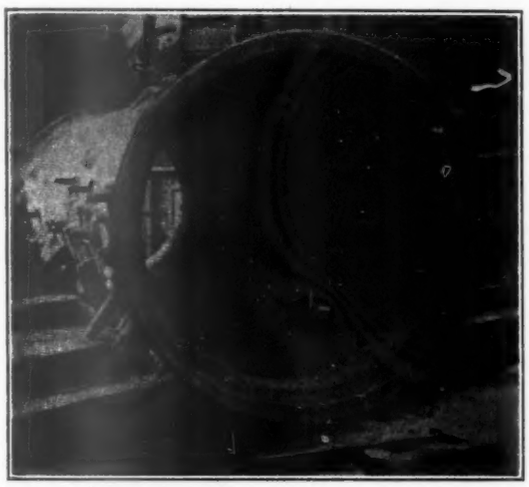

Fig. 13.—Large Bronze Cylinder of Good Design secured through Co-operation between Designer and Foundryman.

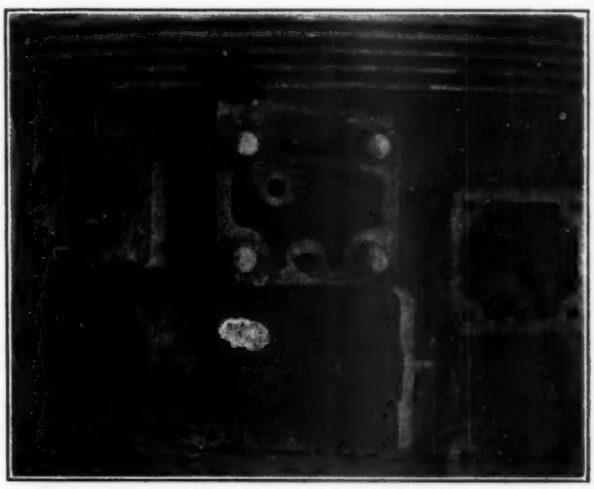

Fig. 14.—Design showing Care taken to Avoid Inequalities in Section of Casting.

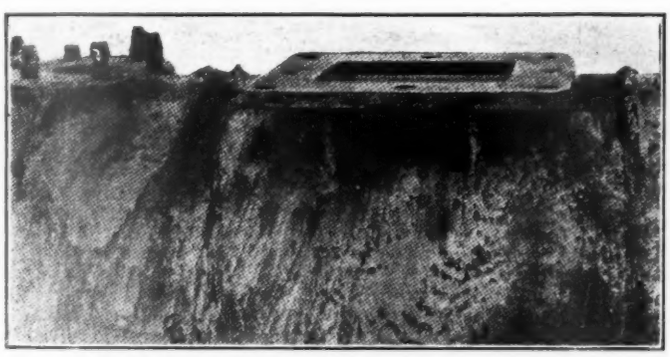

Fig. 15.—Large Rectangular Flange Cored Out underneath to Avoid Inequalities of Section. Note also the Easy Rolling Ribs and Rounded Rib over Key-Way.

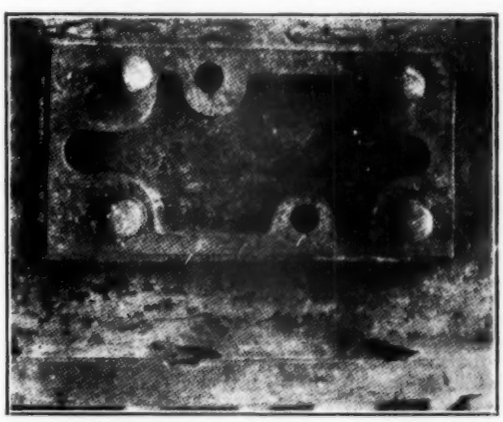

Fig. 17.—Here again a Projection is Cored Out for the sake of Section Uniformity.

An Open-Hearth Furnace for Melting Cast-Iron Borings.*

By T. L. Joseph and C. E. Wood (Minneapolis).

The recent decline in scrap prices has been greater than the decline in prices of pig-iron. Current prices of pig-iron and cast-iron borings offer a substantial financial inducement to fabricating plants that operate foundries and machine shops from which borings segregated as to composition can be obtained. This is particularly true of plants located at remote distances from blast furnaces. Under normal conditions there is a large-price margin in many localities for recovering metal satisfactory in composition, but unsuitable in physical form for melting in the cupola.

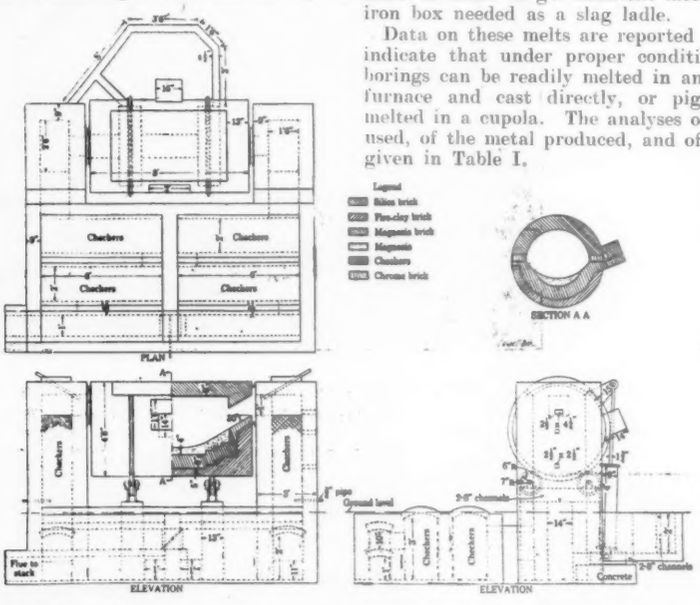

Fig. 1.—Plan and Elevation of United States Bureau of Mines Experimental Open-Hearth Furnace.

It is well known that borings can be melted satisfactorily in an electric furnace. Except for locations where electric current is cheap, costs for open-hearth melting would be cheaper. Flexibility in operation and greater ease in establishing a reducing atmosphere over the bath are recognised as advantages favouring electric-furnace melting. Normally, open-hearth conditions are strongly oxidising. However, during the development of a method for producing ferro-manganese from manganiferous-iron ores, the authors found that reducing conditions could be established over an open-hearth bath by covering it with a layer of small coke several inches deep.

During a three-hour period under a layer of pea coke at a temperature of 1,575 deg. C. the ferrous-oxide in a high-manganese and comparatively viscous slag was reduced from 67 to 4.5 per cent., and the phosphorus from 1.6 to 0.1 per cent. The increase of manganese in the metal is another indication of reducing conditions.

In view of similar results on a large number of heats, it seemed feasible to melt cast-iron borings in an open-hearth furnace, if the borings were properly protected from the flames by coke and slag. Two melts of borings were made in order to get sufficient metal to cast an iron box needed as a slag ladle.

Data on these melts are reported because they indicate that under proper conditions cast-iron borings can be readily melted in an open-hearth furnace and cast directly, or pigged and remelted in a cupola. The analyses of the borings used, of the metal produced, and of the slag are given in Table I.

In melt No. 1, the borings were charged and covered with consecutive layers of high-alumina slag and coke. Coke was added from time to time to keep the bath well covered. As shown in Table I, a small loss of silicon and sulphur occurred in melting. The change in manganese, phosphorus and carbon was slight. The metal was grey and close-grained, but it machined readily.

Table I.—*Composition of Slag and Borings Before and After Melting.*

	Metal.					Slag.				
	Si	S	Mn	P	C	CaO	MgO	SiO_2	Al_2O_3	FeO
Melt No. 1.										
Before melting	1.37	0.084	0.55	0.23	2.92	20.0	24.0	25.0	22.0	3.5
After melting	1.33	0.067	0.64	0.22	2.86	—	—	—	—	—
Melt No. 2.										
Before melting	1.76	0.080	0.55	0.22	2.95	32.0	14.0	20.0	26.0	3.5
After melting	0.76	0.011	0.30	0.20	2.88	—	—	—	—	—

To observe the effect on sulphur elimination, the borings for the second melt were coated with a lime wash and allowed to dry before charging. In place of a batch-type operation as in melt No. 1, the borings were charged at intervals and part of the metal was tapped as it accumulated. The average analysis of the metal tapped shows a loss of about 1 per cent. of silicon, 0.069 per cent. of sulphur, 0.25 per cent. of manganese and a slight decrease in carbon and phosphorus. These two melts show that under some conditions a large part of the sulphur can be eliminated. Whether this can be accomplished without a substantial loss of silicon was not determined.

The silicon could be built up by the addition of ferro-silicon, but it would be more economical to melt under conditions that would give the smallest loss of silicon, even though the reduction in sulphur were small. However, if low-sulphur metal were wanted, it could be obtained from borings.

Data from the small furnace indicate that about 200 lbs. of small coke would be required per ton of metal produced. In melts Nos. 1 and 2, a total of 1,800 lbs. of metal was recovered from 2,000 lbs. of borings, indicating a possible recovery of about 90 per cent. from clean borings free from rust.

Rate of Melting and Fuel Consumption.

The melting rate was about 2,000 lbs. of borings in 4 hrs. By arranging to charge through the roof, it should be possible to melt between 6 and 7 tons per 24 hrs. A furnace about 4 ft. longer than the one shown in Fig. 1 would be more satisfactory, as this would permit better flame propagation and would require less fuel. The estimated melting capacity of such a furnace would be 10 to 12 tons of borings per 24 hrs. Larger furnaces could be built as warranted by the plant production of borings. The furnace used in these tests required about 8 galls. of fuel oil per hour, which would be approximately 30 galls. per ton of borings. With a larger furnace, the oil required per ton probably could be reduced to 25 galls.

* Extracted from a Paper entitled "The Open-Hearth Furnace as a Means of Recovering Cast Iron from Borings," presented at the Detroit meeting of the American Foundrymen's Association, by the authors, who are on the staff of the United States Bureau of Mines.

Book Review.

Tin Solders, by S. J. Nightingale. Published by the British Non-Ferrous Metals Research Association, Regnart Buildings, Euston Street, London, N.W.1. Price 5s.

This book represents our ideal in technical literature. When a person wishes to have information on a certain phase of technology, normally, if it be a metallurgical book, he has to buy a large tome, padded out with chapters on pyrometry, conversion tables, refractory materials and so on. This little book, of 88 pages, never deviates from its purpose of dealing exhaustively with the subject under review. Chapter I, which can be skipped by the metallurgist, should be carefully studied by the "tradesman," as it outlines the type of knowledge requisite for the appreciation of what follows. The next two chapters detail the fundamental physical properties of the range of alloys covered. All this leads up to the best portion of the "strength of soldered joints." Herein is a mass of information of the greatest utility to industry. Once its contents are mastered, soldering practice will be effected better and at less cost. Part II of this work deals practically with the application of the data previously disclosed. Thus, if our previously-mentioned "tradesman" finds himself incapable of assimilating the theoretical aspects, he can with confidence follow the practical precepts detailed for him. The book has no index, but because of its orderly lay-out and detailed contents list it scarcely suffers thereby. Our final word is to be a repetition of our opening paragraph, this book is an ideal technical-reference book.

Publication Received.

Dental Service in Industry. Published by the Industrial Welfare Society, 51, Palace Street, Westminster, S.W.1.

The 50-page brochure forms part of the service which the issuing society gives to industry. Its object—excellently achieved—is to supply the fullest possible information to any firm contemplating the organisation of a dental clinic for the benefit of its employees. Costs, difficulties and benefits are fully dealt with.

Deoxidation of Metals in the Foundry.*

Non-ferrous founders often think that there is little to be learnt about deoxidation, yet it is still practised in many foundries in a totally erroneous way, resulting in deterioration in finish and quality of the castings produced.

This neglect is caused through foundrymen following methods of old-time practical men, and so they do not properly realise the main object of this operation. They are content to put the deoxidiser on the surface of the bath and just stir the molten metal with an iron rod. They place the deoxidiser in the bath and then spend their time looking for the rod, not stirring the mixture until it has been found; so, thinking in all ignorance they have deoxidised correctly, do not trouble themselves any more about the operation. This misconception is a very serious one, for deoxidation has penetrated no lower than half-way, leaving the bottom of the bath untouched. Now, it is more difficult than is generally realised to do this properly, for deoxidisers are lighter than the metals in which they are placed. Thus, with this in mind, more attention should be paid to seeing that the deoxidiser used has had the desired effect, for in this case it has not been used but wasted.

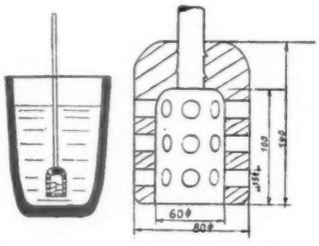

FIG. 1 (LEFT) SHOWS THE SUGGESTED DIVING BELL, AND FIG. 2 (RIGHT) GIVES DIMENSIONS IN MILLIMETRES.

A deoxidiser is not used merely to give fluidity to the bath, but to remove oxygen from it. There are a number of deoxidisers in use to-day, but before making use of them it should be considered (1) if there is a greater affinity for the metal to be deoxidised and (2) if it will give greater fluidity to the bath. If these two conditions are fulfilled, then the deoxidiser will be a suitable one. Should the first only be satisfied, oxides will form through the presence of oxygen, but these oxides, not being able to free themselves from the metal, will remain in the bath to form inclusions, such as are found in copper and nickel alloys.

The choosing of the deoxidiser is not everything, for it must be properly used; mere contact with the surface of the metal is not nearly sufficient—it is essential for it to permeate the whole of the metal—right to the bottom.

To ensure this it is recommended to fix the deoxidiser to the end of an iron rod by means of a piece of copper wire. Before immersing the rod in the bath it should be coated with graphite so as to reduce the tendency to melting. Generally, whilst the metal is being stirred and particles of iron are mixing with the metal, hard spots are formed (this may seem paradoxical, considering the high melting point of iron, but the rod invariably thins out and tapers at the end, resulting in many particles being detached).

When the bath is ready for deoxidation, the end of the iron rod to be immersed is heated and then plunged in right to the bottom, where the deoxidiser melts and begins to act on the metal; a good stirring will help considerably in obtaining the best results.

This method, however, has one fault; that is, the copper wire attaching the deoxidiser to the rod melts rapidly—often before the deoxidiser—and then rises to the surface of the metal. This drawback can be remedied by using a "diving-bell" (Fig. 1). It is a small casting into which the rod is cast-in in the foundry (if the non-ferrous foundry is associated with the iron foundry) or securely screwed in.

In the majority of cases the dimensions outlined in Fig. 2 are quite adequate, with an inside diameter of $2\frac{3}{8}$ in. and sides $\frac{3}{4}$ in. thick, pierced by holes $\frac{5}{8}$ in. dia. With this kind of diving-bell all that is needed is to determine the most convenient method for operation. Before introducing the copper phosphorus, or any other product, in the bell, it should be well heated. Then the deoxidiser is placed in, and the whole enclosed by means of a wooden plug or a piece of cardboard. For deoxidation the diving-bell is plunged right to the bottom of the bath. The liquid metal enters by the holes, melts the deoxidiser, and so the action commences immediately and effectively from bottom to top.

To ensure long life of the diving-bell, and to prevent any intrusion of iron into the bath, it should be coated with graphite before each operation. This method will prevent waste of the deoxidiser or of other purities which are expensive and will assure an efficient action as is possible and also homogeneity, for it dispenses with copper phosphorus, magnesium, copper silicide, soda, zinc chloride and other products.

* Résumé of an Article by R. Berger, "Das Metall," April 3, 1932.

Catalogues Received.

Spectrum Analysis.—"Specpure" substances, including salts, "ratio solutions" and "ratio powders" for quantitative spectrum analysis; and the "Judd Lewis Spectrum Comparator" are the titles of two catalogues sent to us by Messrs. Adam Hilger, Limited, 98, King's Road, Camden Road, London, N.W.1. These catalogues describe two new laboratory aids for the practical spectroscopist; both of these are applicable primarily to the Ratio Quantitative System of Quantitative Spectroscopy devised by Dr. S. Judd Lewis. The "Specpure" substances are salts and solutions of metals (of which over 50 are listed), of the highest purity, spectroscopically controlled. Besides their application to quantitative chemical analysis by the emission spectrum, they may serve many purposes in chemical and physical research, their purity approaching in some cases that accepted in modern atomic-weight determinations. In Dr. Judd Lewis's method the proportion of a minute amount of a minor element in a substance is determined spectrographically in terms of ratio to a dominant element in the substance, by comparison of a spectrum of the substance with one of a ratio powder containing the same dominant element (*e.g.*, calcium) in association with a small known proportion of the minor element (*e.g.*, zinc) to be determined. The proportion of the dominant element in the specimen can, of course, be determined chemically. A number of standardised ratio powders of differing composition suitable for various types of analysis (plant and animal fibres, soil analysis, biological ashes, etc.) are listed, but special ones can be compounded from the "Specpure" solutions to satisfy any routine or individual problems.

Cast-Iron Roads.—A pamphlet, received from Stanton Ironworks Company, Limited, near Nottingham, lists recent orders obtained by them for stretches of cast-iron roads.

The Rise in Tin.

By "ONLOOKER."

In the rout of the bears on the Metal Exchange the spearhead of the attack has been provided by tin, which has pushed its way well above £140 per ton without much encouragement from the consuming trades. Long before the sudden upward turn in metal values which occurred just before the August Bank-holiday the tin market was appreciating, with minor setbacks sufficient to keep interest alive. From the lowest point touched this year tin has gone up something like £40 per ton, and if, as appears not altogether so improbable as it did a few weeks ago, consumptive demand is going to expand and come to the assistance of the speculative movement, which has been mainly responsible for the advance to date, then there does not seem to be any reason why tin should not go ahead still further. There are, however, dangers in the situation.

In spite of every endeavour, however, to improve the statistical position of tin the tonnage overhanging the market remains at an alarmingly high figure, and of the total visible supplies, about 32,500 tons are in stock in this country. Certainly a sufficient reminder that consumers have no need to tumble over each other in an effort to obtain their raw material! The much wanted "holiday" in production is now approaching an end, and at the end of August a net reduction in the tonnage in sight is looked for, but on previous occasions hopes have not always been fulfilled and it may be that once again the carry-over in the East will upset calculations. That metal is not being unduly pressed for sale is of course due to the movements instituted to keep this metal off the market, and only recently it was reported that a second "pool" had come into being. During the past few weeks an enormous tonnage of tin has been purchased by one particular firm on 'Change, and but for this support it is impossible that values could have shot up £20 in four weeks or so. This is the kind of inspired support which has taken tin to a level out of all relation to the existing rate of consumption, and unless the present holders of these big blocks of metal are strong enough to nurse the tonnage over a longish period there is every chance of a serious setback.

It is an old and true saying that speculation may raise values, but that only genuine demand can maintain them, and the tag is certainly very apt as far as the present situation in tin is concerned. It may, perhaps, be argued that curtailment of production and operations by buying pools do not constitute speculation in the accepted sense of the word, but if one considers that the cut in output has not been used solely to correct the topsy-turvey statistical position, with a view to permitting in due course a natural and healthy rise in the quotation, it is obvious that the situation has been "managed." By means of pool buying the market has been afforded artificial support which cannot in any way take the place of the real thing, for the metal thus held off the market temporarily must sooner or later compete with current output, and in the meanwhile the uncertainty of how much tonnage is "frozen" and when it will eventually come on offer induces a state of chronic uncertainty and misgiving among prospective trade purchasers.

The improvement in tin values is doubtless being influenced to some extent by the all-round improvement in commodity prices, but that the situation is vulnerable cannot be denied, and in spite of any further rise in the quotation buyers would be well advised to tread warily.

Leather belts should be periodically dressed with good curriers' dubbin.

For joining earthenware pipes use a putty made from chopped asbestos and silicate of soda.

Foundry Selling Practice.

By Eric N. Simons.

SALES MANAGER AND AGENCIES.

One of the best tests of a capable foundry sales manager is the condition of his agency agreements. Instances have come to light in which every single agent representing a particular firm has had a different type of agreement, often containing many loopholes that did not matter when things were going smoothly, but that were soon used to escape from when times became more difficult. It is axiomatic in sales management, and will be found of endless advantage in actual practice, that a firm should have only one standard form of agreement for all agencies, and that this agreement should, for preference, be drawn up by a solicitor, so as to ensure that it is sound in law. Now this does not mean, as some may assume, that every different agency will be bound to observe a set of cast-iron rules that will be utterly unworkable if applied to particular territories. It is obvious that different circumstances are bound to produce different requirements. One agency may need a consignment stock as part and parcel of its selling system; another may operate on a purely commission basis. But there are certain requirements of all agents that can and should be standardised. A brief examination of what these are may here be made.

It is impossible to give clause by clause a typical standard agency agreement that would be of use to any and every reader. In the first place it would be unwise, because what might be legal for one foundry might not be sound law for another. In the second, the class of business necessitates different requirements. One foundry may sell direct to the consumer, another to the middleman, and so forth.

A few points may, however, be noted. One important clause is that all disputes as to the interpretation of the agreement or any part of it shall be settled by reference to *English* law. This is essential. Otherwise, the foundry may find itself compelled to fee at high rates Continental or other lawyers to tell it exactly where it stands in the light of another country's laws, and may find itself in a very unsatisfactory position. Another valuable clause is that which declares the agreement null and void should the agent become a bankrupt or be guilty of misdemeanours liable to prejudice him in the eyes of his customers or undertake the sale of competing goods without express permission.

Class of Goods and Territory Worked.

The period during which the agreement is to operate should be clearly stated, as also the length of the term of notice to be given on either side. A further point is that the goods to which the agreement relates should be clearly stated, individually as far as possible, or in readily recognisable classes, if to individualise would take up too much time and space. Many instances are known in which, because a particular product was not clearly mentioned in the agency agreement, the agent has been legally entitled to sell and has sold the product of another firm on account of receiving a higher commission. The extent of the territory covered by the agent should also be clearly defined. For example, if he is covering Belgium, it should be indicated whether Luxemburg is included in his territory. If he takes Canada, the extension or otherwise of the agreement to Newfoundland and British Columbia should be specified. All these things eliminate possible future trouble.

Stocks are among the most difficult things to incorporate in agency agreements. The sales manager should be sure that in the agreement it is carefully set down who actually owns the stocks during the period they are in the agent's possession. The exact character of the stock, and its value or extent, should, if this is possible, be noted. If it is a consignment stock, there should be a stipulation that the sizes and amounts stocked on this basis have been and must be approved by the foundry, and that a record of transactions must be submitted by the agent at specified intervals. It is also a good plan to reserve the right to refrain from replenishing any size that moves too slowly. The terms of payment should be stated in terms that leave no ambiguity.

Commissions.—It is advisable to be as precise and detailed here as in the enumeration of the products covered by the agreement. If there is a commission of 5 per cent. on steel castings, and of 10 per cent. on aluminium castings, assuming these to be made by the one firm, and a commission of 6 per cent. on machines as distinct from rough castings, all these varying rates should be noted down in the agreement in detail. Gentlemen's agreements and casual correspondence work very well until the temptation to escape from them becomes too strong, and this point is sometimes reached too swiftly for many English firms by their more supple (and perhaps more impecunious) continental and overseas agents. A good point is to grade commissions according to the quantity of business obtained. For example, when turnover is only £x, 2½ per cent. commission is paid. When it reaches £y, 5 per cent. is paid on the total; if it reachos £z, 7½ per cent. is paid on the total, and so on until the maximum commission feasible on a given output is attained. This gives the agent an incentive to get more business. Any such grading must figure in full in the agreement.

Other important points that crop up in agency agreements are the retaining fees sometimes paid to specially-skilled technical agency men. It cannot be too strongly emphasised here that these allowances should never be irrevocable over a period of years. For a year they should hold good, whatever happens; but after that, they should be subject to revision in the light of turnover. It is easy for an agent to overestimate the extent of his potential turnover, and to keep his employer paying hundreds in retaining fees in the hope, never to be realised, that some day he will reap the reward of his spade-work. A much better plan, and one that has worked satisfactorily in many instances, is to grade retaining fees exactly as with commissions, *i.e.*, according to turnover, increasing the fee as the turnover increases, proportionately. Care should be taken to see that the original basic minimum figure is not set too high. This can be arrived at by estimating the total profit on the annual turnover and ascertaining whether it shows a margin to the good after deducting agency fees and expenses. Thus, if the average profit on the castings is 15 per cent., and the agency turnover is £5,000, the profit thereby represented is roughly £750. Such a turnover will not easily stand a total agency expense in fees, commissions, and expenses, of £700.

Another bone of contention between sales manager and agents is advertising. Almost invariably the agent demands a sum in round figures for preliminary and continuous advertising, first to notify his customers that he has the agency, and later to sustain interest in the foundry product. The sum demanded is often out of all proportion to the market available, and generally the agent demands complete control over the expenditure. The ancient rule that he who pays the piper should call the tune must hold good here, whatever the agent says. Only too often agents, for technical products advertise in cheap general newspapers that are useless as selling media. Nevertheless, the agent must be allowed to make recommendations, as he may have first-hand knowledge of value. But do not assume too readily that everything he says is right. Few agents have really studied the advertising media of their own country, and often they think everyone must read a particular journal because they themselves do. The same fact has been observed in respectable circles here.

The agent who receives a lump sum for advertising should be compelled to supply the foundry with voucher copies, advertisement rates, and receipted invoices, for all advertising he places. This is ordinary business sense, and should not be omitted. What other proof has the firm that its money is being spent wisely and honourably? It is sound policy to incoperate the grading system here, too, and allow more money for advertising as turnover increases. The genuinely enthusiastic and honest agent will never object to a scheme of this sort.

It is bad practice to leave agencies too long to their own devices. Even the smallest and most distant should be visited at some time or other, if only so that the sales manager may assure himself that they are suitable people, that he may have first-hand knowledge of the market, and that the agencies themselves may feel that some interest is being taken in their work, and help given. One final word: make sure that agents are furnished with complete prices and literature, and ensure that they use what they get.

Catalogue Received.

Molybdenum in Cast Iron.—Messrs. High-Speed Steel Alloys, Limited, Ditton Road, Widnes, Lancashire, have now published a third bulletin, outlining a research effected by the Molybdenum Corporation, of America. We want, initially, to congratulate the actual research workers on the control of the composition of the irons used in their experiments, due no doubt to the fact that an acid-lined electric furnace was used, and the increments were added to portions of the charge. The basis irons used were of the order of T.C. 3.20, Si 2.1, Mn 0.67, S 0.098 and P 0.25 per cent., which returned a tensile of about 140 tons per sq. in. In the first series the molybdenum was kept constant at 0.13 per cent., whilst chromium was increased in four stages from 0.07 to 0.31, and, separately, nickel, in three stages, from 0.22 to 1.49. In the second series the molybdenum was standardised at 0.37, with similar chromium additions, but in this case there were six increments of nickel, ranging from 0.31 to 3.93 per cent. In the first series the highest tensile test recorded was with the highest nickel addition. It broke at 18 tons per sq. in. In the second series, wherever comparison is possible, it shows that the increased quantity of molybdenum has increased the tensile, but the influence on the transverse is very erratic. Naturally enough, these alloys are fairly complex, and rational attack is difficult. We are of opinion that the value of this research could be, naturally, enhanced by carrying the work further, to include heat-treatment. If founders go to the expense of adding nickel and molybdenum, they are certainly sufficiently broad-minded to extend the scope of their work to include a heat-treatment department. We appreciated the inclusion of a graph for converting lbs. to tons per sq. in. The pamphlet is available to our readers on request.

Vee belts should be dressed with castor oil to prevent smoothness.

This Week's News in Brief.

Trade Talk.

The Polish steelworks have set up a common selling bureau at Warsaw for three years. A price list has been issued.

At the International Foundry Exhibition, which was held in Milan last September, The Foundry Trade Journal was awarded a diploma of excellence by the Committee.

Messrs. August's, Limited, of King's Cross, Halifax, have booked an order for the complete sand-handling plant of the Wallsend Slipway & Engineering Company, Limited, Wallsend-on-Tyne.

Contracts for improvements to six overhead electric cranes at the London & North Eastern Railway Locomotive Works, Darlington, have been secured by Messrs. Craven Bros. (Herbert Morris, Limited).

The foundries of Yugoslavia last year made 37,762 tons of iron castings, according to the Report of Mr. H. N. Sturrock, Commercial Secretary to His Majesty's Legation at Belgrade, on the economic conditions of that country.

The Manchester Association of Engineers has arranged a visit on September 7 to the works of the Lancashire Steel Corporation, Limited, Irlam, which have recently been extended and undergone considerable alterations.

Mr. Percy Lister, addressing the members of the Electrical Contractors' Association, said that, of all competitors for the new French Government contract, the four-cylinder Lister unit was the only one to stand up to the gruelling 1,000-hr. test imposed.

Crane, Limited, have changed their address from 120, Pall Mall, S.W.1, to 45/51, Leman Street, London, E.1, to where all future communications should be addressed. Their telegraphic address will not be affected, but their new telephone number will be Royal 7343.

The index number of shipping freights for July, 1932, at 16.68, shows a decrease of 2.46 per cent. when compared with the previous month, but is 9.10 per cent. lower than a year ago, according to statistics compiled by the Chamber of Shipping of the United Kingdom.

Messrs. George Brown & Company, Greenock, have received an order to build a coasting vessel of about 400 tons gross for British owners. The vessel will be driven by Diesel engines, and the order for the propelling machinery has been placed with the Newbury Diesel Company.

Openshaw Foundry of Messrs. Joseph Stubbs, Limited.—Mr. W. H. Smith, of the Foundry & Engineering Company (West Bromwich), Limited, has kindly pointed out that the drying stoves in this foundry are 12 ft. wide by 19 ft. deep. We thank Mr. Smith for his correction.

Messrs. John Baker & Bessemer, Limited, of Rotherham, have received an order for wheels and axles for the Danish State Railways, in connection with the electrification of the Danish State Railways, for which British contractors have already secured an order for electric train equipment to the value of £300,000.

The British Aluminium Company, Limited, Adelaide House, King William Street, London, E.C.4, are removing their London warehouse from 34-38, Banner Street, Golden Lane, London, E.C.1, to 23-25, Pancras Road, N.W.1. On and from August 29 all communications for the London warehouse should be addressed to their new premises.

About 200 men employed in the Hallside Steel Works of the Steel Company of Scotland, Limited, at Newton, resumed work on August 16 to effect repairs necessary before work starts in the melting and rolling departments. The works have been closed for some months with even the office staff suspended, and the re-start has caused great satisfaction in the district.

The directors of Qualcast, Limited, light repetition ironfounders, propose to increase the company's capital to £200,000, by the issue of 75,000 7 per cent. cumulative preference £1 shares, in order to finance further expansion of production, and generally to place the company's finance in a more liquid position. The directors state that the profits for the past year again exceeded £30,000.

The first vessel to be built in this country for Soviet Russia, the dredger "Belomorskaya," has completed successful trials on the Clyde. The vessel has been built at high speed by Messrs. Lobnitz & Company, Limited, Renfrew, since February in order that it may proceed to Archangel before the winter. The dredger will leave Renfrew at the end of this month and reach Archangel about four weeks later.

The Royal Dutch Blast Furnace and Steel Works, of Ymuiden, intends to manufacture iron castings, steel and rolled products. So far the works have specialised in the production of pig-iron. The Dutch Government, which has a large interest in the company, has granted a subsidy for the preliminary work. The company mainly aims at covering the demands of the domestic market for the above products. It is also intended to build a foundry for the production of cast-iron pipes.

Members of the Institution of Mechanical Engineers attending the Canadian summer meeting left England on August 19. Arriving at Quebec on August 27, the party will go to Montreal, where an extensive programme of visits to engineering and other concerns has been arranged. After two days spent in Ottawa, the party will leave for Toronto, and a visit will be paid to the Canadian National Exhibition. After visiting Rochester, Schenectady and New York, the return journey will be made on September 9.

Messrs. Clarke, Chapman & Company, Limited, Gateshead-on-Tyne, have secured an order for eleven of their improved "Cyclops" type winches from Messrs. Wm. Gray & Company, Limited, West Hartlepool. These winches are fitted with link motion reversing gear of an extra heavy type, and double and single purchase gearing with helical teeth. All pinions and clutches are of cast steel and the pinions are gunmetal bushed. Each winch is capable of exerting a pull of 3 tons direct from the barrel at 90 ft. per minute in double purchase, with a steam pressure of 100 lbs. per sq. in.

An order has just been placed for a large four-vat "Taylor" patent pickling machine for 12-ft. sheets by an American firm with the patentees and makers, Messrs. Taylor & Sons, Limited, Briton Ferry. This is the third order Messrs. Taylor have received from this particular firm. Messrs. Taylor have also just entered an order for a large four-vat coil-strip pickling plant for one of the most modern works in the country engaged on this class of work. It is very gratifying to find that America still considers they have something to learn in the production of sheets and tinplates from the Old Country.

Messrs. Gustav Zimmermann, of Düsseldorf-Rath, Germany, are exhibiting at the International Foundry Exhibition in Paris in September, and extend a welcome to all British foundrymen to visit their stand during the exhibition. Amongst the machines to be shown are jolt squeeze and turnover moulding machines of Types RPW2, USR2, UGO and PW1; a special machine for the moulding of piston rings (one of the UGO machines will be arranged for stack moulding); a core-blowing machine, "Kernhexe," size 2; and a range of flask dischargers.

Harper & Moores Firebrick Company, Limited, has been formed to acquire and carry on the well-known and old-established firebrick business of Harper & Moores, Limited, at Stourbridge. The colliery undertaking belonging to the latter company has been disposed of. The firebrick portion of the business will be continued under the title of Harper & Moores Firebrick Company, Limited, and the services of the late managing director, Mr. V. R. Westcott, have been retained. The financial position of the new company has also been greatly strengthened, as advantage has been taken to extinguish the whole of the debentures.

Newmains is now the possessor of an excellent playing ground, where workers of the district may profitably utilise their leisure. In the presence of a large attendance the well-equipped recreation ground of 16 acres was formally opened on August 13 by Mr. W. H. Telfer, the managing director of the Coltness Iron Company, Limited, under the auspices of the Newmains and District Miners' Welfare Society. Included in the area is a bandstand given by the Coltness Iron Company. As a memento of the occasion Mr. Telfer was presented with a silver rose bowl and six volumes of Scott's works by the local Welfare Committee. Mr. A. M. Ritchie, convenor of the committee, was presented with a coffee service from Mr. John Steele, F.R.I.B.A., Wishaw, the architect for the scheme.

Personal.

Dr. Richard Seligman, F.Inst.Met., accompanied by Mrs. Seligman, is leaving England for South Africa in September.

Dr. W. Rosenhain, F.R.S., F.Inst.Met., has been appointed an honorary member of the Deutsche Gesellschaft für Metallkunde.

Mr. R. Bevin is now on a visit to this country from New Zealand, and expects to attend next month's autumn meeting of the Iron and Steel Institute in London.

Engineer Vice-Admiral Sir Reginald Skelton, K.C.B., C.B.E., D.S.O., is retiring from the post of Engineer-in-Chief of the Royal Navy at the end of the present year.

Engineer Vice-Admiral Sir Robert Dixon, K.C.B., D.Eng., a former Engineer-in-Chief to the Royal Navy, has been appointed chairman of the Broughton Copper Company, Limited, following the resignation of the chairmanship by Mr. L. Sumner, O.B.E., M.Sc., and a Past-President of the Institute of Metals.

Wills.

Pearson, Alexander, of Worcester, iron-master £46,168

Bayliss, Samuel, of Tettenhall, iron-master £105,811

Howell, Edward, of Cookley, Worcs., late of Birmingham, retired galvaniser £13,858

Keay, Ernest Charles, of Birmingham, chairman of E. C. & J. Keay (1926), Limited, bridge and constructional steel builders £415,518

Lawson, Thomas, Clapham Common, S.W.3, founder and head of the Scottish Foundry Company £47,169

Obituary.

The death occurred at his home in Aberdeen on August 16 of Mr. Thomas Cruden, who was for over thirty years employed by Messrs. Barry, Henry & Cook, Limited, Aberdeen, during the latter part of which he was general works manager. Mr. Cruden, who was 66 years of age, retired about two years ago.

Mr. Albert Ernest Jenks died on Sunday last at his home at Ash Grove, Compton, at the age of 70 years. He was one of the founders in 1882 of the firm of Messrs. A. E. Jenks & Cattell, Limited, at Heath Town and Wednesfield, Wolverhampton. He was also a director of the Deritend Stamping Company, Limited, Birmingham, and Collars, Limited, London.

Mr. Harry James Wilson, Deputy Chief Inspector of Factories since 1923, died recently, aged 62. Having been appointed H.M. Inspector of Factories in 1892, he served in Leeds, Dundee, and Newcastle-upon-Tyne. In 1907 he was promoted to be Deputy Superintending Inspector for Scotland, and in 1916 Superintendent Inspector for Scotland, and was a member of several shipbuilding committees.

New Companies.

Proctor, Avery & Wood, Limited, 59, Allcock Street, Birmingham.—Capital £1,000. Brass and other metal goods. Director: H. I. Watts.

Iron Road (Great Britain), Limited.—Capital £16,600. Directors: T. H. Butler, Chantley, Sneyd Park, Bristol; E. W. Butler, H. G. Spencer.

George Tweedy & Company, Limited, Saunderrake Works, Chipping, near Preston.—Capital £5,000. Ironfounders. Directors: E. J. and E. A. Beech, E. Brooks.

Norvall Bros., Limited, Victoria Grove Works, Victoria Grove, Stoke Newington, N.—Capital £2,000. Electrical and mechanical engineers. Directors: G. H. and E. Norvall.

English Wood Screw Company, Limited, 75, Victoria Street, Westminster, S.W.—Capital £25,000. Directors: M. W. A. Peel Graham, P. Van Thiel-Stokvis, W. J. Maskrey, T. C. Parker.

Regal Manufacturing Company, Limited, 40, Chester Street, Birmingham.—Capital £3,000. General brassfoundry manufacturers. Directors: W. Pilkington, P. T. Ellsmore, R. D. Sansome.

Raw Material Markets.

Quiet conditions prevail in all markets for iron and steel. Home consumers are placing few orders, and the demand from abroad is still very restricted. The holidays account for much of the present slackness. There is a feeling of optimism that the autumn will see a turn for the better. Hopes are based on nothing very tangible yet, but generally it is believed that conditions now favour an upward movement in trade. The outlook internationally is more promising, and another favourable pointer is the gradual increase that has been taking place in world commodity prices, while increased trade with the Dominions is anticipated as the result of the Ottawa Conference. Stocks of iron and steel abroad are known to be low. Lack of confidence has hitherto prevented the replenishment of stocks, but with any pronounced improvement in world trade replacement orders may be expected.

Pig-Iron.

MIDDLESBROUGH.—Only a small business is being done in Cleveland iron, but there is confidence in the future position. There was a general resumption of work in this district on Monday, and operations have also been restarted at the Skinningrove works, which were closed a few weeks ago to enable the change-over to the electricity grid to be made. Actually, demand for pig-iron this week has not been large, but there has been more inquiry, and it is believed that consumers who had been holding back will soon again be in the market. Very few export sales have taken place. Prices, f.o.t. or f.o.b., are:—No. 1 Cleveland foundry iron, 61s. per ton; No. 3 Cleveland G.M.B., 58s. 6d.; No. 4 foundry, 57s. 6d.; No. 4 forge, 57s. per ton.

The demand for hematite remains very restricted. The East Coast makers hold considerable stocks and the tendency of the market is still weak. For East Coast mixed numbers not more than 60s. is obtainable. The West Coast hematite trade is equally slack.

LANCASHIRE.—Although the volume of business placed by Lancashire consumers is not at all heavy, it is better than in the early part of the month, and more interest is being shown. The dispute in the cotton industry is a depressing factor in this area, but there is nevertheless considerable optimism so far as iron and steel is concerned. Few branches of the foundry industry show much life at present, but there is some satisfaction to be gained from the fact that the improvement in overseas business in textile machinery continues. Prices are steady, with little prospect of any movement in one direction or the other. For delivery to users in the Manchester price zone, Derbyshire, Staffordshire and North-East Coast brands of No. 3 iron are on offer on the basis of 67s. per ton, with Northamptonshire foundry iron at 65s. 6d., Derbyshire forge at 62s., Scottish foundry at around 84s. 6d., West Coast hematite at about 81s., and Indian brands at from about 67s. to 77s. per ton, according to quality.

MIDLANDS.—Most of the foundries in the Black Country find conditions very slack still, but the light-castings makers expect to experience an improvement soon. The demand for pig-iron at the moment is below the supply, and the makers have to put iron into stock, in spite of the fact that only a small number of furnaces is working. In the circumstances there is considerable competition for orders at the fixed prices for this area. Prices are: Northants No. 3, 62s. 6d. per ton; Derbyshire, Lincolnshire and North Staffordshire No. 3, 66s., including delivery to Birmingham and Black Country stations. There is no indication of Continental foundry iron becoming competitive in the Midland Counties. Forge pig-iron is quoted at 5s. per ton below the No. 3 foundry level, but the demand is poor, the ironworks being engaged only intermittently. Quiet conditions rule in the hematite market. The larger consumers are already covered, and the orders being placed at present are mostly for small quantities to meet users' early needs.

SCOTLAND.—The official price of Scottish foundry iron remains unchanged at 69s. 6d. for No. 3, with No. 1 at 72s. Middlesbrough iron is obtainable at Falkirk at 55s. 6d. for No. 3, and Midland brands are available at slightly below this figure. Consumers generally are poorly engaged and are buying from hand to mouth. Both the engineering and light-castings foundries are slack, and the malleable works also have only small requirements. The steelworks are not interested in pig-iron at the moment, as they are carrying fair stocks and are themselves poorly engaged.

Coke.

The market for foundry coke naturally follows the trend of the pig-iron trade, and at the moment the demand is slack. Prices, however, are firm. For delivery to Birmingham and district 37s. 6d. is quoted for best Durham foundry coke, with other grades at about 2s. 6d. less. Prices of Welsh foundry coke vary from 30s. up to 45s. per ton, according to analysis. The demand for furnace coke also is restricted.

Steel.

The steel markets are under the influence of summer conditions, but with the approach of the end of the holiday season some improvement is noticeable in the volume of inquiry. The better feeling in the market lately has been strengthened by the result of the Ottawa Conference, and it is generally believed that when details of the agreements are made known it will be found that the British steel industry and some of the Empire markets will benefit. The official report of the London Iron and Steel Exchange states that the demand for semi-finished steel is quiet, and no great activity is likely until the large stocks in consumers' hands have been considerably reduced. Continental competition is keen, but the number of orders going in this direction is much less now than in the early part of the year, despite the low prices which are being quoted. In the finished-steel department conditions are irregular, and while some works are fairly well off for orders others find it difficult to keep plant steadily in operation. Export business has been quiet for some time, but latterly consumers in overseas markets have shown more interest.

Scrap.

Very little business has been done in the Cleveland scrap market, and prices are unchanged. Heavy cast iron, though in poor demand, keeps steady at 35s. per ton for ordinary and 36s. for machinery quality, while light castings are quoted at 30s. In South Wales, heavy cast iron in large pieces and furnace sizes appears to have a slightly improved demand, and is steady at 42s. 6d. Good cast-iron machinery scrap is far from active, as the local foundries are not busy, and a limited volume of business is being done at 45s. to 47s. 6d. In the Midlands, heavy machinery metal, broken into cupola sizes, is offered at 45s. to 47s. 6d. delivered, heavy pipe and plate scrap at 40s. and clean light cast scrap at 35s. 6d. delivered. In Scotland, cast-iron borings are maintaining their price of 30s. per ton, as the production is small. The cast-iron scrap market is weak, and machinery quality, in pieces not exceeding 1 cwt., can be had freely at 43s. to 44s., with ordinary cast iron, to the same specification, at 39s. per ton.

Metals.

Copper.—This market has shown some slight recovery on the week. There has been no great improvement in the intrinsic position of the metal, but sentiment is better, owing to the firmness in Wall Street and the increased confidence in the commodity markets. There does not seem to be much room for a fall in the value of copper at the present prices, and generally a higher level seems to be looked for. Consumption has not materially increased, but it is believed that users have requirements to be filled, orders for which have been delayed by the uncertainties of the position.

Closing quotations :—

Cash.—Thursday, £30 17s. 6d. to £31; Friday, £31 1s. 3d. to £31 3s. 9d.; Monday, £31 12s. 6d. to £31 13s. 9d.; Tuesday, £33 7s. 6d. to £33 10s.; Wednesday, £34 5s. to £34 10s.

Three Months.—Thursday, £30 17s. 6d. to £31; Friday, £31 1s. 3d. to £31 2s. 6d.; Monday, £31 11s. 3d. to £31 12s. 6d.; Tuesday, £33 2s. 6d. to £33 3s. 9d.; Wednesday, £33 16s. 3d. to £33 18s. 9d.

Tin.—The demand for tin is not brisk, but the market has had some support and prices are rather higher. Recent advances have led to a cautious attitude on the part of users, and it is believed that any reaction in values would lead to the placing of orders.

Official closing prices :—

Cash.—Thursday, £140 12s. 6d. to £140 15s.; Friday, £142 to £142 5s.; Monday, £141 12s. 6d. to £141 15s.; Tuesday, £143 10s. to £143 12s. 6d.; Wednesday, £142 15s. to £142 17s. 6d.

Three Months.—Thursday, £142 10s. to £142 15s.; Friday, £143 10s. to £143 15s.; Monday, £143 5s. to £143 7s. 6d.; Tuesday, £145 to £145 5s.; Wednesday, £144 10s. to £144 12s. 6d.

Spelter.—Values of spelter have remained fairly steady. There is confidence in the underlying strength of this metal. Statistically the position is better and is likely to improve further. Consumers, however, are not buying very much at the moment, seeming to fear a reaction in prices.

Daily fluctuations :—

Ordinary.—Thursday, £13 17s. 6d.; Friday, £14 1s. 3d.; Monday, £13 17s. 6d.; Tuesday, £14 1s. 3d.; Wednesday, £14 2s. 6d.

Lead.—Prices in this market have got to higher levels. Trade demand has improved slightly, and with a return of confidence should show a further advance.

The week's prices have been :—

Soft foreign (prompt).—Thursday, £11 5s.; Friday, £11 13s. 9d.; Monday, £11 13s. 9d.; Tuesday, £11 17s. 6d.; Wednesday, £11 15s.

Statistical Abstract for the British Empire.—The Statistical Abstract for the British Empire for each of the seven years 1924 to 1930 inclusive has now been published. The volume contains the usual information relating to population, finance, production, transport and communications, trade and commerce, retail and wholesale prices index, numbers of various countries, etc. Copies may be obtained by H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2. (Price 5s. net.)

Competition from Weldings.—Mr. E. H. Ballard, the President of the American Foundrymen's Association, in opening the 36th Annual Convention of that body, stated that the foundry industry as a whole had not been as keen and alert as it should have been. This had resulted in suddenly finding other products taking the place of castings. He had personal knowledge of 150 tons of castings per week being replaced by fabricated units; much of this lost business was not justified from an economic standpoint. He was confident that the tide had turned, as there were many cases where the same simple designs produced by fabrication were now being changed to castings, and combinations of fabrications and castings were being produced at a financial saving. This change from castings to weldings had without question been of much help to foundrymen, in that designing engineers have had their attention directed to casting design as never before, and the foundryman had been made to realise his responsibility in assisting in simplification of designs, and the production of superior castings at lower costs. Much, however, had yet to be done.

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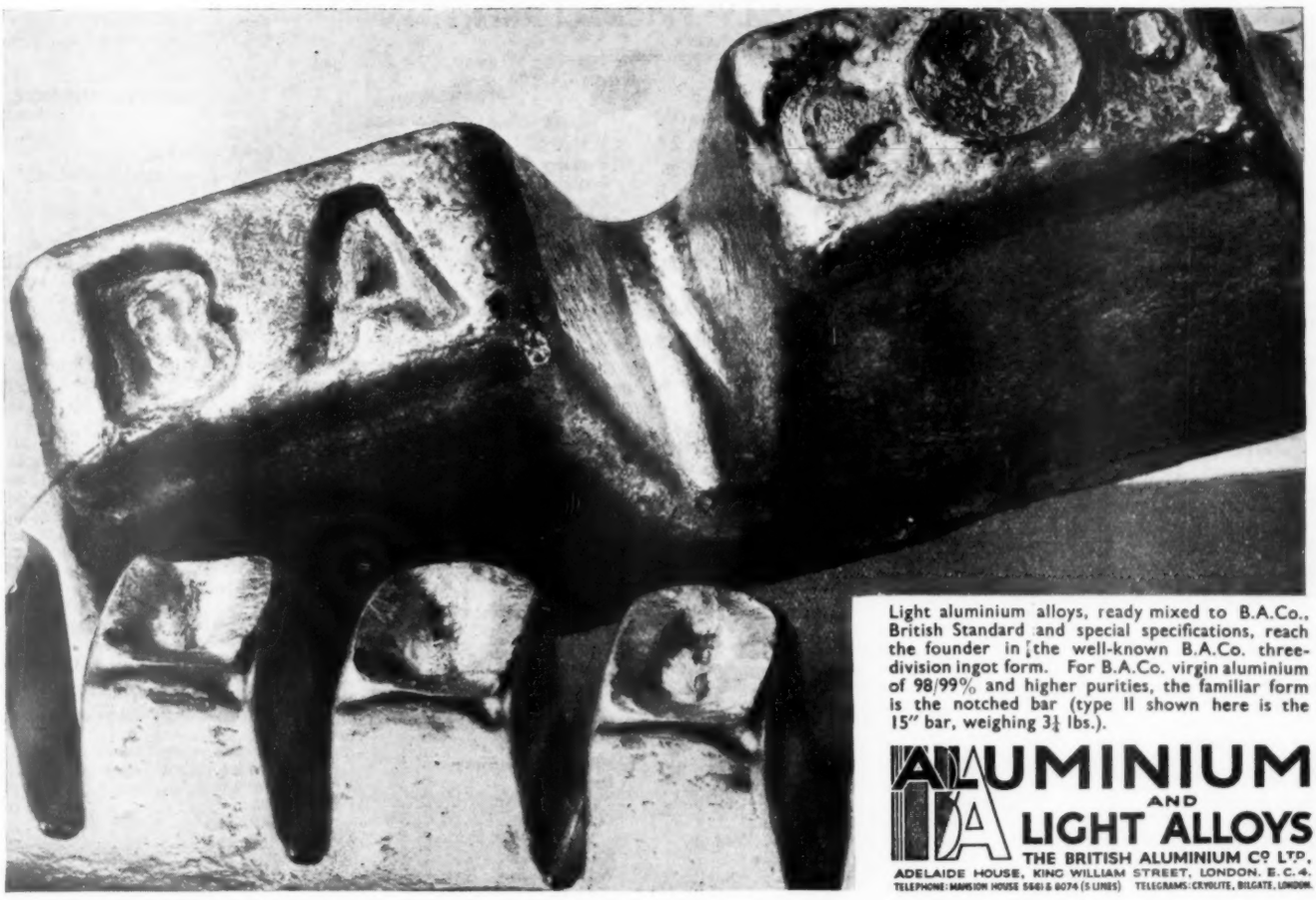

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SPECIAL & ORDINARY FOUNDRY QUALITIES & FORGE
SPECIAL REFINED WITH TOTAL CARBON
GUARANTEED NOT EXCEEDING 3·0% MAX.
COLVILLES LTD
GLASGOW

WEEKLY PRICE CURRENT.

COPPER.

	£ s. d.
Standard cash	34 5 0
Three months	33 16 3
Electrolytic	36 10 0
Tough	35 5 0
Best selected	35 15 0
Sheets	62 0 0
India	44 0 0
Wire bars	36 10 0
Do., Sept.	36 10 0
Do., Oct.	36 10 0
Ingot bars	36 10 0
H.C. wire rods	38 0 0
Off. av. cash, July	26 2 5 9/11
Do., 3 mths., July	25 13 6½
Do., Sttlmnt., July	26 1 10½
Do., Electro, July	29 10 0
Do., B.S., July	28 15 10
Do., wire bars, July	29 17 10½
Solid drawn tubes	10d.
Brazed tubes	10d.
Wire	6½d.

BRASS.

Solid drawn tubes	9d.
Brazed tubes	11d.
Rods, drawn	7½d.
Rods, extd. or rlld.	5½d.
Sheets to 10 w.g.	7½d.
Wire	7½d.
Rolled metal	7d.
Yellow metal rods	4½d.
Do. 4 × 4 Squares	5½d.
Do. 4 × 3 Sheets	5½d.

TIN.

	£ s. d.
Standard cash	142 15 0
Three months	144 10 0
English	144 10 0
Bars	147 0 0
Straits	148 0 0
Australian	146 0 0
Eastern	149 0 0
Banca	153 0 0
Off. av. cash, July	125 19 5½
Do., 3 mths., July	127 12 3½
Do., Sttlmt., July	125 19 0½

SPELTER.

	£ s. d.
Ordinary	14 2 6
Remelted	13 0 0
Hard	11 5 0
Electro 99.9	16 10 0
English	14 17 6
India	13 5 0
Zinc dust	20 0 0
Zinc ashes	2 0 0
Off. aver., July	11 15 6¾
Aver. spot, July	11 11 10½

LEAD.

	£ s. d.
Soft foreign ppt.	11 15 0
Empire	12 7 6
English	13 15 0
Off. average, July	9 19 8¾
Average spot, July	9 16 4¾

ZINC SHEETS, &c.

	£ s. d.
Zinc sheets, English	22 10 0
Do., V.M. ex-whf.	21 10 0
Rods	26 0 0
Boiler plates	—
Battery plates	—

ANTIMONY.

	£ s. d.
English	35 0 0 to 42 10 0
Chinese	23 10 0
Crude	16 0 0

QUICKSILVER.

	£ s. d.
Quicksilver	9 5 0

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon—	
25%	£8 5 0
45/50%	£13 10 0
75%	£19 10 0
Ferro-vanadium—	
35/50%	12/8 lb. Va.
Ferro-molybdenum—	
70/75% c. free of Mo.	6/3 per lb.
Ferro-titanium—	
23/25% carbon-free	11½d. lb.
Ferro-phosphorus, 20/25%	£22 0 0
Ferro-tungsten—	
80/85%	1/9 lb.
Tungsten metal powder—	
98/99%	2/- lb.
Ferro-chrome—	
2/4% car.	£34 0 0
4/6% car.	£25 5 0
6/8% car.	£24 10 0
8/10% car.	£22 7 6
Ferro-chrome—	
Max. 2% car.	£37 0 0
Max. 1% car.	£46 15 0
Max. 0·70% car.	£45 17 6
70% carbon-free	1/1 lb.
Nickel—80/99.5%	£240 to £245
"F" nickel shot	£216 0 0
Ferro-cobalt	7/9 lb.
Aluminium 98/99%	£95 0 0
Metallic chromium—	
96/98%	2/9 lb.
Ferro-manganese (net)—	
76/80% loose	£10 15 0 to £11 5 0
76/80% packed	£11 15 0 to £12 5 0
76/80% export (nom.)	£9 15 0
Metallic manganese—	
94/96% carbon-free	1/4½ lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 5/16 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅛ in.	3d. lb.
Do., under ¼ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP.

	£ s. d.	£ s. d.
South Wales—		
Heavy steel	1 18 0	to 1 19 0
Bundled steel and shrngs.	1 15 0	to 1 18 0
Mixed iron and steel		1 15 6
Heavy cast iron	2 0 0	to 2 2 6
Good machinery	2 5 0	to 2 7 6
Cleveland—		
Heavy steel		1 15 0
Steel turnings		1 8 0
Cast-iron borings		1 2 6
Heavy forge		2 10 0
W.I. piling scrap		2 2 6
Cast-iron scrap	1 15 0	to 1 16 0
Midlands—		
Light cast-iron scrap		1 15 0
Heavy wrought iron		2 2 6
Steel turnings, f.o.r.		0 19 0
Scotland—		
Heavy steel		1 15 0
Ordinary cast iron		1 19 0
Engineers' turnings		1 8 0
Cast-iron borings		1 10 0
Wrought-iron piling		2 0 6
Heavy machinery		2 3 6

London—Merchants' buying prices delivered yard.

	£ s. d.
Copper (clean)	22 0 0
Brass	15 0 0
Lead (less usual draft)	9 10 0
Tea lead	8 0 0
Zinc	7 0 0
New aluminium cuttings	74 0 0
Braziery copper	20 0 0
Gunmetal	18 0 0
Hollow pewter	75 0 0
Shaped black pewter	60 0 0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—	
Foundry No. 1	61/-
Foundry No. 3	58/6
Foundry No. 4	57/6
Forge No. 4	57/-
Hematite No. 1	60/6
Hematite M/Nos.	60/-
N.W. Coast—	
Hem. M/Nos. d/d Glas.	72/6
,, d/d Birm.	84/6
Malleable iron d/d Birm.	117/6
Midlands—	
Staffs No. 4 forge*	61/-
,, No. 3 fdry.*	66/-
Shrops basic	—
,, Cold blast, ord.	—
,, ,, roll iron	—
Northants forge*	57/6
,, fdry. No. 3*	62/6
,, fdry. No. 1*	65/6
Derbyshire forge*	61/-
,, fdry. No. 3*	66/-
,, fdry. No. 1*	69/-
,, basic*	—

*d/d Black Country dist.

Scotland—	
Foundry No. 1	72/-
,, No. 3	69/6
Hem. M/Nos. d/d	68/6
Sheffield (d/d district)—	
Derby forge	58/6
,, fdry. No. 3	63/6
Lincs forge	—
,, fdry. No. 3	63/6
E.C. hematite	74/-
W.C. hematite	83/6
Lancashire (d/d eq. Man.)—	
Derby forge	62/-
,, fdry. No. 3	67/-
Staffs fdry. No. 3	67/-
Northants fdry. No. 3	65/6
Cleveland fdry. No. 3	67/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	84/6
Clyde, No. 3	84/6
Monkland, No. 3	84/6
Summerlee, No. 3	84/6
Eglinton, No. 3	84/6
Gartsherrie, No. 3	84/6
Shotts, No. 3	84/6

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

	£ s. d.	£ s. d.
Iron—		
Bars (cr.)	9 5 0	to 9 15 0
Nut and bolt iron	7 15 0	to 8 10 0
Hoops	10 10 0	to 12 0 0
Marked bars (Staffs) f.o.t.	12 0 0	
Gas strip	10 10 0	to 12 0 0
Bolts and nuts, ¾ in. × 4 in.	12 0 0	
Steel—		
Plates, ship, etc.	8 15 0	to 8 17 6
Boiler plts.	8 7 6	to 9 5 0
Chequer plts.		10 7 6
Angles		8 7 6
Tees		9 7 6
Joists		8 15 0
Rounds and squares, 3 in. to 5½ in.		9 7 6
Rounds under 3 in. to ¼ in. (Untested)	6 12 6	& up.
Flats—8 in. wide and over		8 12 6
,, under 8 in. and over 5 in.		8 17 6
Rails, heavy	8 5 0	to 8 10 0
Fishplates		12 0 0
Hoops (Staffs)		9 10 0
Black sheets, 24g.	8 0 0	to 8 10 0
Galv. cor. shts.	9 5 0	to 9 15 0
Galv. flat shts.	10 0 0	to 10 15 0
Galv. fencing wire, 8g. plain		12 10 0
Billets, soft	4 17 6	to 5 7 6
Billets, hard		6 12 6
Sheet bars	4 15 0	to 5 5 0
Tin bars		4 15 0

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	10½d.
Sheet to 10 w.g.	11½d.
Wire	11½d.
Rods	10½d.
Tubes	16d.
Castings	12½d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated

	Dols.
No. 2 foundry, Phila.	14.34
No. 2 foundry, Valley	14.50
No. 2 foundry, Birm.	11.00
Basic	15.39
Bessemer	16.89
Malleable	16.39
Grey forge	16.39
Ferro-mang. 80%, seaboard	68.00
O.-h. rails, h'y, at mill	43.00
Billets	26.00
Sheet bars	26.00
Wire rods	37.00
	Cents.
Iron bars, Phila.	2.11
Steel bars	1.60
Tank plates	1.60
Beams, etc.	1.60
Skelp, grooved steel	1.60
Steel hoops	1.45
Sheets, black, No. 24	2.20
Sheets, galv., No. 24	2.85
Wire nails	1.95
Plain wire	2.20
Barbed wire, galv.	2.60
Tinplates, 100-lb. box	$4.75

COKE (at ovens).

Welsh foundry	20/- to 22/6
,, furnace	16/- to 16/6
Durham and Northumberland—	
,, foundry	21/- to 25/-
,, furnace	12/-
Midlands, foundry	—
,, furnace	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. cokes 20×14 per box	15/- to 15/3
,, 28×20 ,,	30/- to 30/6
,, 20×10 ,,	22/- to 22/3
,, 18¾×14 ,,	15/6 to 15/9
C.W. 20×14 ,,	13/- to 13/3
,, 28×20 ,,	—
,, 20×10 ,,	—
,, 18¾×14 ,,	—

SWEDISH CHARCOAL IRON & STEEL.

Pig-iron	£6 0 0 to £7 0 0
Bars-hammered, basis	£16 10 0 to £17 0 0
Bars and nail-rods, rolled, basis	£15 17 6 to £16 5 0
Blooms	£10 0 0 to £12 0 0
Keg steel	£32 0 0 to £33 0 0
Faggot steel	£18 0 0 to £23 0 0
Bars and rods dead soft, st'l	£10 0 0 to £12 0 0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS.

Standard Copper (cash).

		£	s.	d.	
Aug. 18	..	30	17	6	dec. 6/3
,, 19	..	31	1	3	inc. 3/9
,, 22	..	31	12	6	,, 11/3
,, 23	..	33	7	6	,, 35/-
,, 24	..	34	5	0	,, 17/6

Electrolytic Copper.

		£	s.	d.	
Aug. 18	..	34	15	0	dec. 5/-
,, 19	..	34	15	0	No change
,, 22	..	35	0	0	inc. 5/-
,, 23	..	35	10	0	,, 10/-
,, 24	..	36	10	0	,, 20/-

Standard Tin (cash).

		£	s.	d.	
Aug. 18	..	140	12	6	dec. 42/6
,, 19	..	142	0	0	inc. 27/6
,, 22	..	141	12	6	dec. 7/6
,, 23	..	143	10	0	inc. 37/6
,, 24	..	142	15	0	dec. 15/-

Tin (English ingots).

		£	s.	d.	
Aug. 18	..	142	10	0	dec. 40/-
,, 19	..	144	0	0	inc. 30/-
,, 22	..	143	10	0	dec. 10/-
,, 23	..	145	0	0	inc. 30/-
,, 24	..	144	10	0	dec. 10/-

Spelter (ordinary).

		£	s.	d.	
Aug. 18	..	13	17	6	No change
,, 19	..	14	1	3	inc. 3/9
,, 22	..	13	17	6	dec. 3/9
,, 23	..	14	1	3	inc. 3/9
,, 24	..	14	2	6	,, 1/3

Spelter (Electro, 99.9 per cent.).

		£	s.	d.	
Aug. 18	..	16	5	0	No change
,, 19	..	16	10	0	inc. 5/-
,, 22	..	16	5	0	dec. 5/-
,, 23	..	16	10	0	inc. 5/-
,, 24	..	16	10	0	No change

Zinc Sheets (English).

		£	s.	d.	
Aug. 18	..	22	10	0	No change
,, 19	..	22	10	0	,, ,,
,, 22	..	22	10	0	,, ,,
,, 23	..	22	10	0	,, ,,
,, 24	..	22	10	0	,, ,,

Lead (English).

		£	s.	d.	
Aug. 18	..	13	5	0	dec. 5/-
,, 19	..	13	15	0	inc. 10/-
,, 22	..	13	15	0	No change
,, 23	..	13	15	0	,, ,,
,, 24	..	13	15	0	,, ,,

AVERAGE MONTHLY PRICES OF FURNACE COKE D/D MIDDLESBROUGH.

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1901	0 17 6	0 14 0	0 13 0	0 14 0	0 14 6	0 15 0	0 15 3	0 15 3	0 15 9	0 16 6	0 16 9	0 16 9	0 16 4½
1902	0 16 9	0 15 0	0 15 0	0 15 0	0 15 0	0 15 3	0 15 3	0 15 3	0 15 6	0 16 0	0 16 6	0 16 0	0 15 5
1903	0 15 9	0 16 0	0 16 3	0 16 9	0 16 6	0 16 3	0 16 0	0 15 9	0 15 6	0 15 0	0 14 6	0 14 0	0 15 8½
1904	0 13 9	0 13 9	0 13 3	0 14 3	0 14 6	0 14 3	0 14 3	0 14 3	0 14 3	0 14 0	0 14 0	0 14 6	0 14 1½
1905	0 14 9	0 15 3	0 15 3	0 15 3	0 15 6	0 15 6	0 15 6	0 15 6	0 15 6	0 15 6	0 15 9	0 17 0	0 15 5½
1906	0 17 6	0 17 6	0 17 0	0 17 0	0 17 0	0 16 6	0 17 0	0 17 0	0 18 3	0 18 6	0 19 0	1 0 0	0 17 8½
1907	1 4 6	1 5 0	1 5 0	1 0 6	1 2 0	1 1 0	1 1 0	1 1 0	1 2 0	1 1 6	1 0 0	0 17 0	1 1 8½
1908	0 16 0	0 16 0	0 15 6	0 16 0	0 16 3	0 16 0	0 15 6	0 15 6	0 15 6	0 15 3	0 16 0	0 16 0	0 15 9½
1909	0 16 0	0 15 3	0 15 0	0 14 9	0 15 6	0 15 9	0 15 6	0 15 6	0 16 6	0 17 0	0 17 6	0 17 0	0 15 11½
1910	0 18 4½	0 18 6½	0 18 0	0 18 0	0 17 10½	0 17 0	0 16 1½	0 15 9½	0 15 11	0 16 0	0 15 9½	0 15 8	0 16 11
1911	0 16 0	0 15 10½	0 15 6	0 15 3	0 14 9	0 14 6	0 14 6	0 14 6	0 14 6	0 14 11½	0 15 0½	0 16 3½	0 15 1½
1912	0 17 3	0 17 3	0 18 6	0 18 10	0 19 0	0 19 4½	0 19 10½	1 0 9½	1 2 9	1 4 1½	1 5 8½	1 8 6	1 1 0
1913	1 5 9	1 4 11	1 5 0	1 5 0	1 4 9½	1 0 4½	0 19 5½	0 18 3	0 18 0	0 18 2½	0 18 6	0 18 6	1 1 4½
1914	0 18 2	0 17 1	0 17 0	0 17 0	0 17 4	0 17 6	0 17 6	0 18 5	0 18 4	0 17 9	0 17 6	0 18 5	0 17 8
1915	0 17 10½	0 17 9	1 0 4½	1 7 7½	1 9 4½	1 10 7½	1 9 7	1 7 3	1 5 4	1 4 9	1 9 6	1 13 0	1 6 1
1916	1 10 9	1 10 6	1 10 6	1 10 6	1 10 6	1 10 6	1 10 6	1 10 6	1 10 6	1 10 6	1 10 6	1 10 6	1 10 6½
1917	1 10 6	1 10 6	1 10 6	1 10 6	1 10 6	1 10 6	1 10 6	1 10 6	1 10 6	1 10 6	1 14 3	1 15 6	1 11 2½
1918	1 15 6	1 15 6	1 15 6	1 15 6	1 15 6	1 15 6	1 15 6	1 15 6	1 15 6	1 15 6	1 15 6	1 15 6	1 15 6
1919	1 15 6	1 15 6	1 15 6	1 15 6	2 1 6	2 1 6	2 3 9	2 10 6	2 10 6	2 10 6	2 10 6	2 10 6	2 3 5
1920	2 12 3	2 14 0	2 19 0	2 19 0	3 3 8	3 6 0	3 6 0	3 6 0	3 6 0	3 6 0	3 6 0	3 6 0	3 2 6
1921	3 1 0½	2 19 0	2 16 0	2 7 0	2 6 6	2 6 6	2 0 6	2 0 0	1 13 11	1 12 9	1 10 4½	1 8 3	2 3 6½
1922	1 7 0½	1 8 1½	1 9 7½	1 8 4½	1 7 11½	1 7 3	1 6 9½	1 6 10½	1 7 0½	1 10 2½	1 10 0	1 9 11½	1 8 3½
1923	1 11 3	1 14 6	2 0 1½	2 2 8½	2 4 4½	2 2 10½	2 1 0½	2 1 6	2 0 9½	1 18 9	1 18 8½	1 18 3	1 19 7½
1924	1 16 6½	1 14 9	1 11 11½	1 10 0½	1 8 1½	1 7 8½	1 7 3	1 6 3	1 6 0	1 5 0	1 5 0	1 5 0	1 9 5½
1925	1 4 10½	1 4 1½	1 13 3	1 2 4½	1 2 2½	1 1 5½	1 1 3½	1 4 9	0 18 10½	0 18 4½	0 19 6½	1 1 4½	1 2 8½
													(5 months)
1926	1 2 1½	1 0 9	0 19 2½	0 18 6½	Strike	Strike	Strike	Strike	Strike	Strike	Strike	1 5 0	1 1 1½
1927	1 5 6	1 4 9½	1 6 1½	1 3 9	1 2 6	1 0 8½	0 19 4½	0 19 0	0 18 7½	0 18 0	0 17 10½	0 17 6	1 1 1½
1928	0 17 6	0 17 10½	0 18 0½	0 17 11½	0 17 8½	0 17 6½	0 17 7½	0 17 6½	0 17 6	0 17 7½	0 17 7½	0 17 6	0 17 8
1929	0 17 7½	0 18 0	0 19 0	0 19 6½	0 18 10½	0 19 10½	1 1 3½	1 1 8½	1 3 0	1 3 6	1 3 8	1 3 1½	1 0 9½
1930	1 2 6½	1 1 3	1 0 3	0 19 1½	0 17 7	0 16 10½	0 16 6	0 16 6	0 16 9	0 17 0	0 17 0	0 17 0	0 18 2½
1931	0 17 0	0 16 7½	0 16 0	0 16 0	0 15 11	0 15 5	0 15 1	0 15 0	0 15 0	0 16 9	0 17 0	0 16 6	0 16 0½
1932	0 17 0	0 16 11½	0 16 5½	0 15 9	0 15 7½	0 15 6	0 15 6	—	—	—	—	—	—

WILLIAM JACKS & COMPANY,

WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

CLARENCE CHAMBERS, 39, CORPORATION STREET, BIRMINGHAM.

13, RUMFORD STREET, LIVERPOOL.

PIG IRON

REGISTERED TRADE MARK

LIMPET

All grades FOUNDRY, HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM JACKS & COMPANY,

CENTRAL CHAMBERS, 93, HOPE ST., GLASGOW, C.2.

ZETLAND ROAD, MIDDLESBROUGH.

SITUATIONS VACANT AND WANTED.

FOUNDRY FOREMAN desires position; practical and technical training all branches; grey iron, semi-steel, malleable, die-casting, and all non-ferrous metals. Take entire charge foundry and patternshop.—Box 242, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

FOUNDRY MANAGER desires engagement. Had exceptional experience in the practical, technical and metallurgical control of all types of chilled, grain and alloy rolls, cupola and air-furnace, and in general, electrical and rolling-mill castings, ingot moulds and blocks to 100 tons.—Box 254, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

FOUNDRY SUPERINTENDENT required by Messrs. W. H. Allen, Sons & Co., Ltd., Bedford, to take charge of their Iron and Brass Foundries. Applicants must have had experience in the production of small iron castings from green sand and large castings from dry sand and loam moulding, also non-ferrous castings including gunmetal, bronze and aluminium. The duties will necessitate metallurgical knowledge and capacity for taking entire charge of all personnel connected with the Foundries. Applications addressed to the Secretary must embrace age, qualifications, experience and salary required.

AGENCIES.

LONDON export merchant house with 50 years' connection Continental consumers would undertake exclusive export sale of Specialities for Foundries and Steel Works, etc. Have also extensive connection London export houses.—Reply to Box 252, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

WANTED, by Core Oil Manufacturers, Agent in Scotland for Core Oils. Must have good connection with foundries. Exceptional opportunities and good commission paid to right person.—Box 250, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

PROPERTY.

MAGNIFICENT

11 ACRES WORKS SITE.

SHEFFIELD.

145,000 Sq. Ft. of Shops.

SIDING CONNECTIONS

with L.M. & S. and L. & N.E. Rlys.

WELL-BUILT & COMMODIOUS OFFICES

Will Sell whole or in lots to suit customers or Let on favourable terms. Unique opportunity for Manufacturers.

Apply—

THOS. W. WARD, LTD.,

ALBION WORKS, SHEFFIELD.

FOUNDRY for Sale, with two modern 6-ton Cupolas, Steel Staging, Electric Hoist; Sidings alongside.—Further details, Box 246, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

MACHINERY.

THOS. W. WARD, LTD.

Worthington Hori. Duplex Pump, 10" x 6" x 10".

Hori 3-throw Hyd. Pumps, 3½" rams, 12" str. 1,500 lbs. press.

Vert. 3-throw geared Hyd. Pumps, 2" rams x 6" str. 1,500 lbs. press.

3 Lancs. Boilers, 30' x 8', 150 lbs. w.p.

14 N.H.P. Port Steam Engine and Boiler.

ALBION WORKS, SHEFFIELD.

'Grams: Forward. 'Phone, 23001 (10 lines).

"Albion" Catalogue on application.

MACHINERY—*Continued.*

WANTED, Sand Slinger, portable type, not later than 1928.—Reply, Box 238, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

THOMAS C. WILD, LIMITED,
Electrical and Mechanical Engineers,
Freedom Works, John Street, Sheffield.

SECONDHAND BLOWERS, IN FIRST-CLASS CONDITION.

ONE 12-in. KEITH BLACKMAN CUPOLA BLOWER, Motor 220/250 volts D.C., 40 h.p., 1,630/2,800 r.p.m. Complete with new Brookhirst Controller Panel.

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